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COPE PROGRAM
PROGRESS REPORT FOR FY 92

COPE Advisory Council Meeting
LaSells Stewart Center
Oregon State University, Corvallis, Oregon
9:30 a.m., June 2, 1992

TABLE OF CONTENTS

COPE Program
Progress Report*

Table of Contents

Item *Page*

Introduction i

Meeting Agenda ii

COPE Advisory Council Members iii

Cooperating Organizations v

Minutes of COPE Advisory Council Meeting of November 21, 1992 vi

Progress Reports:

Fundamental COPE Studies 1

Adaptive COPE Studies and Technology Transfer Activities 102

Proposed Fundamental and Adaptive Studies for FY 93 145

Relationship of Research Studies to COPE Management Issues and Research Tasks 166

Budgets for FY 92 and FY 93

Fundamental COPE 179

Adaptive COPE 180

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* Compiled by Steve Hobbs (Program Manager) and Beverly Newton, Forestry Sciences Laboratory, 3200 S.W. Jefferson Way, Corvallis, OR 97331. (503) 750-7426.

INTRODUCTION

Dear Cooperators:

As in previous progress reports, the COPE Progress Report for FY 92 provides an update on each of 39 ongoing fundamental and adaptive studies as well as technology transfer activities. In addition, plans for six new studies are also included. Budgets for Fundamental and Adaptive COPE for the current fiscal year and FY 93 are contained on the last two pages of the report.

In Fundamental COPE, Tom Spies and Joe Means have changed the title of the "Integration" study (page 26) to "Coastal Landscape Analysis and Modeling" to reflect a shift in study emphasis. We feel that simulating vegetation change in the central Oregon Coast Range under different management scenarios, with associated changes in harvestable timber, wildlife and fish habitats, and economics, is achievable. This would provide managers with a powerful tool for exploring the potential consequences of major, policy-level decisions on how we manage our forests and streams. Also noteworthy is a new timber harvesting proposal (page 147) by Loren Kellogg that would replace his existing study (page 53). This new study could be started immediately and is in response to changes in Adaptive COPE research.

In Adaptive COPE, we welcomed John Hayes as the new Wildlife Habitat Scientist on May 18. John is stationed in Newport at the Hatfield Marine Science Center with the rest of the Adaptive Team.

Since the last meeting of the Advisory Council on November 21, 1991, we have consolidated Adaptive COPE research. Adaptive COPE involvement in the forage seeding study (page 139) has been discontinued. However, this research will be completed by Oregon State University's CRAFTS Program. We are also proposing that the IRDAP study (page 124) be replaced by two new studies (pages 158 and 162). The objectives of these studies are similar to those of IRDAP but can be achieved on a smaller, more efficient scale. Both studies can be started immediately and will involve timber harvesting operations. One of these studies will focus on active riparian zone management and will be done in conjunction with Loren Kellogg's fundamental study "Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range" (page 147).

The research and technology transfer activities outlined in this report are in keeping with the objectives and research tasks contained in the program's long- range plan. As always, our primary goal is to provide the most objective information possible that is pertinent to existing and emerging resource management issues in the Oregon Coast Range.

Steve Hobbs
Program Manager

MEETING AGENDA
ADVISORY COUNCIL MEMBERS
COOPERATING ORGANIZATIONS

AGENDA

COPE Advisory Council Meeting
Agricultural Science Room, LaSells Stewart Center
Oregon State University, Corvallis, Oregon
9:30 a.m., June 2, 1992

Time	*Topic*	*Discussion Leader*
9:30 a.m.	Welcome and Introductory Remarks	Barte Starker Charles Philpot George Brown
10:00	Fundamental COPE Brief Status Report New Studies, FY 93 Fundamental Budget, FY 93	Steve Hobbs
10:20	Adaptive COPE Brief Status Report New Studies and Technology Transfer, FY 93	Arne Skaugset
10:50	Coffee Break	
11:00	Adaptive COPE Budget Long-term Budget Outlook Communications specialist FY 93 Budget	Steve Hobbs
11:30	Discussion	Barte Starker
12:00 p.m.	Adjourn	

May 1992

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- Bureau of Land Management
- Pacific Northwest Research Station
- Siskiyou National Forest
- Siuslaw National Forest
- U.S. Fish and Wildlife Service

State Agencies

- Department of Fish and Wildlife
- Department of Forestry
- Oregon State University

Oregon Counties

- Benton
- Coos
- Curry
- Douglas
- Polk
- Washington

Forest Industries

- Boise Cascade Corporation
- Georgia-Pacific Corporation
- Giustina Land & Timber Company
- Hydraulic & Machine Services, Incorporated
- James River Corportation
- Longview Fibre Company
- Papé Brothers, Incorporated
- Rosboro Lumber Company
- Roseburg Resources Company
- RSG Forest Products, Incorporated
- Smurfit Newsprint Corporation
- Starker Forests, Inc.
- Stimson Lumber Company
- Weyerhaeuser Company
- Willamette Industries, Incorporated
- Willamina Lumber Company

Oregon Small Woodland Association

MINUTES OF THE ADVISORY COUNCIL MEETING
NOVEMBER 21, 1991

Minutes of the COPE Advisory Council Meeting
Hatfield Marine Science Center
Newport, Oregon
November 21, 1991

Council members present: John Byrne, Mel Chase, John Christie, Ray Craig, Dennis Creel, Don Davis, Wendy Herrett, Nancy MacHugh, Joyce Morgan, Jim Rombach (vice John Wilkinson), Harold Sawyer, Barte Starker, Al Tocchini, Gary Varner

Others present: Jerry Asher, George Brown, Mike Collopy, Hank Froehlich, Stan Gregory, Andy Hansen, Bruce VanHaveren, Steve Hobbs, Joe Lint, Bill McComb, George Moeller, Dale Rettmann, Barbara Schrader, Tom Spies, Gabe Tucker, John Zasada

Barte Starker opened the meeting by welcoming Council members and other participants. He then asked for a motion to approve the minutes of the June 11, 1991 meeting. The motion was so moved, seconded, and approved by the Council. Barte then invited George Moeller and George Brown to make opening comments.

George Moeller told the Council that reorganization of the Forest Service Pacific Northwest Research Station has been completed and that COPE interfaces nicely with many of the new programs. He also said that the FY 92 PNW budget for COPE looks good and that the program is viewed positively by the Forest Service. The scientist staffing problem that Adaptive COPE has experienced is of concern to the Station and they are considering ways of putting a PNW scientist on the Adaptive Team.

George Brown recognized Mike Collopy as the director of the new Bureau of Land Management research unit now located on the OSU campus. George congratulated Don Davis on his retirement after many successful years as the City Manager of Newport. He then told the group that COPE research will serve the state well, particularly work related to riparian areas. Barte Starker agreed and said that the issue of riparian management is important to the state and that the research community should play a significant role in this issue. He then turned the meeting over to Steve Hobbs.

Steve provided the Council with a brief overview of Fundamental COPE studies. In FY 91 there were 27 studies; 11 on reforestation-related topics, 15 on riparian zone management, and one on recreation. In FY 92 there will be a total of 30 studies; 12 in reforestation, 15 in riparian zone management, and one each in recreation, timber harvesting, and socioeconomics. Steve also told the Council that scientists involved in fundamental research had also been active in technology transfer. In FY 91 Fundamental COPE scientists gave 58 presentations, produced 16 publications and authored 10 COPE Report articles.

Following Steve's presenation, Gabe Tucker gave the Council an update on Adaptive COPE activities. He reviewed existing adaptive studies in reforestation and riparian zone management. Gabe also told the Council that a slidetape on riparian zone management had been completed and was available from the College of Forestry's Media Center. He then outlined the status of the Interdisciplinary Research and Demonstration Area Project (IRDAP). Gabe reviewed the basic study objectives and treatments and noted that finding suitable research areas was a problem although there were several new possibilities yet to be explored. This study also has a strong harvest engineering component that will be conducted as a fundamental study by Loren Kellogg. Gabe then went on to describe the FY 91 and FY 92 budgets for Adaptive COPE. He indicated that although there is currently a large carryover, this will be reduced quickly because costs are increasing while base funding has not kept pace.

Steve Hobbs then introduced five scientists who gave the Council brief five-year summaries of research in major subject areas. These were: riparian vegetation, Tom Spies; fisheries, Stan Gregory; wildlife, Bill McComb; reforestation, John Zasada; and landslides, Hank Froehlich. There were questions and some discussion from Council members for each presentation but the Council was generally pleased with the progress that has been made.

A list of potential final information products for the program was presented by Steve Hobbs. He explained how the COPE Science Committee had developed the list and worked toward identifying potential final program products that will integrate and synthesize the tremendous amount of information that is likely to be developed. Steve told the Council that although completion of the program is not scheduled until 1998, it is not too early to be thinking about final products. Council members agreed but the suggestion was made that specialists from cooperating organizations should be involved in the process. Steve agreed. The discussion then shifted to the issue of public awareness of the COPE Program.

Steve told the Council that in discussions he had had with communications/public affairs specialists in both the private and public sectors, that three components are necessary in order to mount an effective public awareness program. These are: an organizational commitment to provide the necessary funding, a coordinator, and a communications plan. Steve made the point that to be effective a specialist would have to be hired but that currently funds were not available to do this. There was some discussion among Council members but the issue was not resolved. Steve agreed to discuss possible options in detail with Barte Starker prior to the next meeting and report back to the Council.

There was no further discussion and Barte Starker adjourned the meeting at 12:30 p.m.

Minutes by Steve Hobbs, Program Manager

PROGRESS REPORTS:
FUNDAMENTAL COPE STUDIES ADAPTIVE COPE STUDIES and TECHNOLOGY TRANSFER ACTIVITIES

LIST OF PROGRESS REPORTS FOR FY 1992
FUNDAMENTAL COPE STUDIES

Page

I. *Riparian Zone Management*

A. Ecology and Inventory of Riparian Zone Vegetation (Tom Spies and Jim Sedell, PNW; John Tappeiner, and David Paine, OSU) 4

B. Fish Habitat and Riparian Zone Interactions (Stan Gregory, Bob Beschta, Gary Lamberti and James Hall, OSU; Fred Everest, Gordon Reeves, Jim Sedell, and Fred Swanson, PNW) 8

C. Forest Management on Landslide-Prone Sites: Stability Evaluation, Effectiveness of Leave Areas, and Effects of Landslides on Riparian and Fisheries Resources (Hank Froehlich, and Kevin Lautz, OSU; Fred Swanson, PNW) 13

D. Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach (Bill McComb, Bob Anthony, Chuck Meslow and Joseph Beatty, OSU) 16

E. Hybrid Poplar and Red Alder in Coastal Riparian Zones for Non-point Source Pollution Control, Fish and Wildlife Habitat, and Wood Fiber (Jim Sedell, PNW; Bill Emmingham, Dave Hibbs and Stan Gregory, OSU) 20

F. Ground Water Movement in Steep Forested Hill-slopes with Particular Focus on Marginally Stable "Head-walls" (Marvin R. Pyles, Hank Froehlich and Arne Skaugset, OSU) 23

G. Coastal Landscape Analysis and Modeling (Thomas Spies, Joseph Means, Gordon Reeves, William McComb, Robert Beschta, Gay Bradshaw, Gordon Grant, Stanley Gregory, Andrew Hansen 26

H. The Dynamics and Silviculture of Riparian Vegetation (David Hibbs, William Emmingham and John Tappeiner, OSU; Samual Chan, PNW) 31

Page

I. Disturbance History, Channel State, Fish Habitat, and Fish Production in Sandstone Basins of the Central Oregon Coast (Fred Everest, Gordon Reeves and James Sedell, PNW; Lee Benda, Univ. of Washington) 35

J. Behavior of Debris Torrents and Effects on Anadromous Fish Habitat in the Oregon Coast Range (Fred Everest, Gordon Reeves and James Sedell, PNW; Lee Benda, Univ. of Washington) 37

K. Estimation of Smolt Production from Lobster Creek Study Basin (Fred Everest, Gordon Reeves and James Sedell, PNW; Stanley Gregory, OSU) 40

L. Ecology and Habitat Relationships of Selected Riparian-Associated Wildlife (Robert Anthony, Charles Meslow, and William McComb, OSU) 43

M. The Utilization of Unconstrained Stream Reaches by Salmonids in the Oregon Coast Range (Gordon Reeves and James Sedell, PNW) 46

N. Evaluation of Anadromous Salmonid Habitat Restoration Program on Schooner Creek, Hebo Ranger District, Siuslaw National Forest (James Sedell and Gordon Reeves, PNW; Robert Metzger and Carl McLemore, USFS; Mario Salozzi, Oregon Dept. of Fisheries and Wildlife; Ron Rhew, OSU; Northwest Steelheaders) 49

O. Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions (Loren Kellogg, OSU) 53

P. Strength Behavior of Forest Soils Under True Field Stresses (Richard Bell, Warren Schroeder, and Marv Pyles, OSU) 57

Q. Integrating and Managing Recreation with Other Resources (Perry Brown and George Stankey, OSU; Roger Clark,PNW) 60

R. Socioeconomic Research Feasibility Study (Steven Daniels, OSU) 63

Page

II. *Reforestation in the Oregon Coast Range*

A. Ecology and Management of Shrubs and Hardwoods in Coastal Forests (John Tappeiner and Steve Radosevich, OSU; John Zasada, PNW) 65

B. Characterization of the Thermal Environment for Developing Guidelines to Manage Shrubs and Hardwoods in Coastal Forests (Roger Ottmar, PNW) 69

C. Second Decade Effects of Site Preparation on Tree and Vegetation Development With and Without Precommercial Thinning (Bill Stein, Pete Owston, and John Zasada, PNW) 72

D. Species Manipulation as a Strategy to Reduce the Impact of Laminated Root Rot in Regenerated Coastal Stands (Walt Thies, PNW) 76

E. Asymbiotic Nitrogen Fixation in Large Woody Residues of Oregon Coastal Forests (C.Y. Li, Randy Molina, and Ralph Crawford, PNW) 80

F. Characterization of *Trichoderma* spp.: Prelude to Biological Control (Earl Nelson, PNW) 83

G. Rate of Spread of *Phellinus weirii* in Living vs Dead Root Systems (Earl Nelson, PNW) 86

H. Chemical Control of *Phellinus* (*Poria*) *weirii* Part III--Application of Chloropicrin or Methyl Isothiocyanate (MS) to Live Infected Trees (Walter Thies, PNW) 89

I. The Influence of Tree Vigor on Infestation of Douglas-fir by *Phellinus weirii* (Everett Hansen, OSU; Ellen Goheen and Walter Thies, PNW) 92

J. Identification of Potential Brush and Hardwood Problem Sites (Don Minore, PNW) 95

K. Decision Support System for Reforestation in the Oregon Coast Range (Pat Cunningham and Lauri Shainsky PNW; Steve Knowe, Steve Radosevich, and Tim Harrington, OSU) 98

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Ecology and Inventory of Riparian Zone Vegetation

2. *Principal Investigator(s) and Organization(s)*:

Dr. Thomas A. Spies, Research Forester, Pacific Northwest Research Station, Corvallis
Dr. John C. Tappeiner, Professor, Department of Forest Resources, College of Forestry, OSU, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis
Dr. David P. Paine, Professor, Department of Forest Resources, College of Forestry, OSU, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

c. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

d. Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

4. *Study Objective(s)*:

a. Conduct an inventory of major vegetation types for representative subbasins within three Oregon Coast Range basins using photogrammetric and remote sensing techniques.

b. Characterize existing riparian vegetation structure and spatial distribution within representative basins according to stream size, valley width and gradient, geomorphology and other factors.

c. Characterize vegetation and large woody debris dynamics in streamside forests.

d. Determine response of streamside vegetation to flooding, mass movement, and other natural disturbances.

5. *Potential Benefit or Utility of the Study*:

Currently, the vegetative species composition, structure, stocking, and density are unknown for coastal Oregon riparian zones. A riparian vegetation inventory is fundamental and essential to any study of riparian zones in coastal Oregon. Quick results are necessary in order to select research sites for both extensive and intensive basin and stand level studies. The survey will also be necessary for any economic modeling effects.

Management of riparian zones is severely hindered by a lack of information about the ecological characteristics and dynamics of riparian zone vegetation. Vegetation is closely linked to stream processes, fish habitat, wildlife habitat, and regeneration of commercially valuable timber species. However, relatively few studies of the structure and ecology of riparian zone vegetation have been undertaken in the Oregon Coast Range. In order to develop comprehensive management plans that allow for multiple resource benefits from active riparian zone management, information on the ecology of riparian vegetation must be developed and provided to managers and other COPE scientists.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Completed field sampling for riparian forest stand productivity study.

Completed sampling in Elk Creek Basin for riparian vegetation.

b. Tasks Yet to Be Completed in FY 92:

Initiate sampling in Nestucca River for riparian vegetation.

Continue monitoring and installation of permanent plots in central coast range to study regeneration/disturbance.

Continue intensive mapping for Drift Creek and Lobster Valley as requested.

Finish work on canopy index model.

c. Planned for FY 93:

Monitor regeneration/disturbance plots.

Monitor reference stand mortality.

d. Tasks to Be Completed By Fiscal Year Starting in FY94:

FY 1994
Remeasure plots for regeneration/disturbance study.

Monitor reference stand mortality.

FY 1995
Use mortality data in conjunction with coarse woody debris model to evaluate wood input rates from reference stands.

Monitor regeneration/disturbance plots.

FY 1996
Continue mortality survey.

Complete analysis of coarse woody debris inputs based on mortality.

Monitor regeneration/disturbance plots.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Poster Presentation "Patterns of Plant Species Diversity and Distribution in Riparian Zones of Oregon Coast Range", Seventh Annual Landscape Ecology Symposium, Rob Pabst and Thomas Spies.

b. Planned for Remainder of FY 92:

Participate in field tours, seminars, and workshops, as appropriate.

Prepare manuscript on the canopy index model.

Prepare manuscript on riparian zone plant communities.

c. Planned for FY 93:

Prepare manuscript on mapping forest tree stems.

Participate in field tours, seminars, and workshops, as appropriate.

8. *Estimated Cost:*

	OSU	PNW	TOTAL
FY 92	125,000	63,000	188,000
FY 93	130,000	66,000	196,000
FY 94	133,000	58,000	191,000
FY 95	79,000	48,000	127,000
FY 96	81,000	38,000	119,000

9. *Duration of the Study:*

Initiation date:	FY 87
Scheduled completion date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Fish Habitat and Riparian Zone Interactions

2. *Principal Investigator(s) and Organization(s)*:

Dr. Stanley V. Gregory, Associate Professor, Department of Fisheries and Wildlife, College of Agricultural Sciences, OSU, Corvallis
Dr. Robert L. Beschta, Professor, Department of Forest Engineering, College of Forestry, OSU, Corvallis
Dr. Fred H. Everest, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. Gary Lamberti, Assistant Professor, Department of Fisheries and Wildlife, College of Agricultural Sciences, OSU, Corvallis
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis
Dr. Frederick J. Swanson, Research Geologist, Pacific Northwest Research Station, Corvallis
Dr. James D. Hall, Professor, Department of Fisheries and Wildlife, College of Agricultural Sciences, OSU, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

c. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

d. Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

4. *Study Objective(s):*

To describe relationships between riparian zones and critical fish habitat and to provide a foundation for basin-wide fisheries management.

a. To describe relationships between the distribution and abundance of salmonids and the geomorphic characteristics of basin landforms as a foundation for managing fisheries resources within entire drainage basins.

b. To describe the influence of riparian zone composition and structure on the distribution and abundance of salmonids.

c. To identify management strategies for maintaining riparian characteristics critical for salmonid populations in coastal basins.

d. To evaluate practices for mitigating loss of riparian resources or habitat for fisheries of coastal drainages. (This objective will be developed in future years as a basin context is developed for interpretation.)

5. *Potential Benefit or Utility of the Study:*

A variety of social, political, and environmental factors are forcing rapid change in management of fish habitat through the management of riparian zones, large woody debris, and instream structures. These management activities are seldom considered in a basin-wide context, a perspective that is essential for successful management of the fishery resource, particularly where mixed ownership patterns prevail.

Results of this study will provide vital data for planning, designing, and implementing management plans for riparian zones and fish habitat. Criteria will be developed for identifying critical areas of fish habitat.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Monitored fish communities in winter for the habitat complexity study (stream rehabilitation project) in Camp Creek in the Lobster Creek basin.

Completed weekly spawner survey for Camp Creek.

Initiated 1992 temperature network in Lobster Creek basin.

Conducted a comparison of the results of interagency (BLM, USFS, ODFW, OSU) study on habitat inventory methods in East Fork Lobster Creek.

b. Tasks Yet to Be Completed in FY 92:

Coordinate with Fish Habitat Project scientists to investigate interactions between habitat, temperature, and food in Lobster Creek basin.

Monitor habitat and salmonid abundance in Flynn Creek, Deer Creek, and Needle Branch for long-term evaluation of Alsea Watershed Study.

Investigate food-habitat relationships in stream rehabilitation project in Lobster Creek basin.

Maintain stream temperature network in Lobster Creek basin and evaluate thermal loading throughout basin temperature model.

c. Planned for FY 93:

Investigate mechanisms responsible for patterns of salmonid distribution and abundance.

Integrate basin-level information.

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

FY 1994
Same as 1993.

FY 1995
Develop basin-scale fish habitat model.

Synthesize information for coastal Oregon basins.

Investigate mechanisms related to fish habitat patterns emerging from synthesis.

FY 1996
Synthesize information for coastal Oregon basins.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Presented paper on "Influence of Basin Geomorphology on Fish Distributions in the Drift Creek Basin" at the Oregon Chapter of the American Fisheries Society, Bend, Oregon, February 14, 1992.

Presented paper on "Ecological Methods for Stream Rehabilitation" at Governor's Watershed Enhancement Board Annual Meeting in Portland, Oregon, January 9, 1992.

Presented paper on "Management of Riparian Zones and Stream Ecosystems" at Phoenix Training Center Course for Bureau of Land Management in Ashland, Oregon, March 17, 1992.

Participated in field review of the revision of the riparian rules for the Oregon Forest Practices Act at the invitation of Oregon Department of Forestry on April 16, 1992.

Presented paper on "Ecology and Management of Streams and Rivers" in Ecosystem Management shortcourse for Oregon Department of Forestry on April 28, 1992.

Presented paper on "Steam Ecosystems and Riparian Management" for College of Forestry shortcourse (directed by Bill McComb) on March 24, 1992.

b. Planned for Remainder of FY 92:

Prepare manuscript on fish distributions and abundance in Lobster Creek basin.

Prepare an article for the **COPE Report**.

Participate in field tours, seminars, and workshops, as appropriate.

c. Planned for FY 93:

Participate in field tours, seminars, and workshops, as appropriate.

Prepare an article for the **COPE Report**.

Prepare manuscript on responses of fish communities to habitat complexity and food availability.

8. *Estimated Cost:*

	OSU	*PNW*	*TOTAL*
FY 92	133,000	111,000	244,000
FY 93	138,000	117,000	255,000
FY 94	141,000	123,000	264,000
FY 95	93,000	91,000	184,000
FY 96	63,000	63,000	126,000

9. *Duration of the Study:*

Initiation date:	FY 87
Scheduled completion date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Forest Management on Landslide-Prone Sites: Stability Evaluation, Effectiveness of Leave Areas, and Effects of Landslides on Riparian and Fisheries Resources

2. *Principal Investigator(s) and Organization(s)*:

Dr. Henry A. Froehlich, Professor, Department of Forest Engineering, College of Forestry, OSU, Corvallis
Dr. Frederick J. Swanson, Research Geologist, Pacific Northwest Research Station, Corvallis
Mr. Kevin Lautz, Research Assistant, Department of Forest Engineering, College of Forestry, OSU, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

b. Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.

c. Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

4. *Study Objective(s)*:

a. Compare and evaluate existing approaches to judging the stability of headwalls. If existing approaches prove to be inadequate, develop an improved method of evaluating headwall stability appropriate for field use.

b. Evaluate the role tree roots play in mitigating landslide activity within steep headwalls.

c. Determine where streamside buffer blowdown is likely to occur and if stream sediment levels significantly increase when wide-spread blowdown does occur.

d. Characterize the timing and rate of movement of large-scale landslides. Evaluate the effects of forest cutting on movement.

e. Examine variations in precipitation intensity and amounts throughout the Coast Range. Relate rainfall characteristics to landslide activity.

5. *Potential Benefit or Utility of the Study:*

Evaluation of slope stability in marginally stable areas forms the basis for management decisions on Federal, State, and private land. This research will result in the development of a better system for the evaluation of slide potential after clearcutting.

Also, this study will provide information for managing riparian areas to minimize buffer blowdown and associated stream sedimentation.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Preliminary analysis of headwall landslide data set shows no significant difference in slide frequency between forested headwalls and clearcut headwalls.

All headwall sites were viewed by helicopter to evaluate this method for mapping landslides. Even from treetop level few slides could be located under uncut forest sites.

b. Tasks Yet to Be Completed in FY 92:

Continue to collect precipitation data.

Complete M.S. Thesis on blowdown in buffer strips to incorporate remeasurement data.

Make final analysis of full data set.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Complete publication preparation.

Participate in field tours, seminars, and workshops, as appropriate.

8. *Estimated Cost*:

	OSU	*PNW*	*TOTAL*
FY 92	0	0	0

9. *Duration of the Study*:

Initiation date:	FY 87
Scheduled completion date:	FY 92

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach

2. *Principal Investigator(s) and Organization(s):*

Dr. William C. McComb, Associate Professor, Department of Forest Science/Department of Fisheries and Wildlife, OSU, Corvallis
Dr. Robert G. Anthony, Assistant Leader, Oregon Cooperative Wildlife Research Unit/Department of Fisheries and Wildlife, OSU, Corvallis
Dr. E. Charles Meslow, Leader, Oregon Cooperative Wildlife Research Unit/Department of Fisheries and Wildlife, OSU, Corvallis
Dr. Joseph J. Beatty, Instructor, Department of Zoology, OSU, Corvallis

3. *Management Issues and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

a. Identify wildlife species in and adjacent to riparian habitats.

b. Characterize wildlife communities in riparian and adjacent upland habitats and assess associations between habitat and wildlife species.

c. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas.

d. Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

4. *Study Objective(s):*

a. Determine the relative abundance of vertebrate species and quantify patterns of vertebrate community structure and diversity along transriparian and intrariparian gradients in Coast Range watersheds.

b. Quantify food and cover along transriparian and intrariparian gradients in a representative set of Coast Range watersheds.

c. Assess habitat associations and the zone of riparian influence for selected species that may be sensitive to riparian zone disturbance.

d. Extensively sample habitat and vertebrate communities at sites throughout the Coast Range that represent a continuum of habitat conditions.

e. Develop and test hypotheses regarding the response of species and communities to changes in vegetation structure and composition within and adjacent to riparian zones.

f. Evaluate opportunities to manipulate vegetation to optimize simultaneous production of wildlife habitat and timber.

5. *Potential Benefit or Utility of the Study*:

There is currently almost no information which permits objective evaluation of tradeoffs for wildlife management in riparian zones. Controversies over the current Forest Practices Rules makes the need for this information a high priority. The goal of this research is to provide this needed information. Riparian zones receive water, nutrients and energy from upstream sources along the stream gradient, so they are potentially very productive ecosystems. They could add significantly to the food base of a watershed, thereby affecting vertebrate community structure. Variability in food and cover ought to be maximized through time along three spatial gradients: parallel to the stream (increasing floodplain size), perpendicular to the stream (moisture gradient), and vertically from the forest floor to the canopy. Characteristics of the stream and adjacent forest will influence these gradients. Research will be directed to provide information to develop prescriptions at a basin level in coordination with fisheries and forest ecologists working on other COPE projects.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Continued sampling birds in subbasins under varying levels of mature forest and two levels of mature forest fragmentation.

Complete report on beaver habitat relationships in Coast Range streams: Suzuki, Nobuya. 1992. Habitat classification and the influence of beaver ponds on riparian small mammal and amphibian communities in the Oregon Coast Range. MS Thesis, OSU, Corvallis, Oregon. 85pp.

Began intrariparian bird community pilot study.

b. Tasks Yet to Be Completed in FY 92:

Complete report on small mammal and amphibian abundance in managed and unmanaged stands.

Begin intrariparian stream-amphibian pilot study.

Continue sampling bird communities along an intrariparian gradient as a pilot study.

Continue sampling bird communities along riparian gradients in managed sub-basins.

c. Planned for FY 93:

Begin intrariparian sampling study.

Continue sampling in managed sub-basins.

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

FY 1994
Complete field sampling in managed subbasins and begin data analysis. Continue sampling intrariparian gradients.

Begin sampling birds, small mammals, and amphibians in buffer strips of varying widths.

FY 1995
Complete report on bird communities in managed subbasins.

Continue intrariparian study.

Continue study on buffer strip widths.

FY 1996
Analyze data and prepare reports describing the results of intrariparian bird communities and influence of buffer strip width on bird, small mammal and amphibian communities.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

McGarigal, K. and W.C. McComb. 1992. Streamside versus upslope breeding bird communities in the central Oregon Coast Range. J. Wildl. Manage. 56:10-23.

Suzuki, N. 1992. Habitat classification and characteristics of small mammal and amphibian communities in beaver-pond habitats of the Oregon Coast Range. M.S. Thesis. 85 pp.

Presentation to Oregon Board of Forestry, Salem, Oregon.

Presentation to Bureau of Land Management biologists, Springfield, Oregon.

b. Planned for Remainder of FY 92:

Prepare manuscript on riparian and upslope relationships of small mammals and amphibians in managed and unmanaged stands of the central Oregon Coast Range.

Prepare manuscript on small mammal and amphibian association with beaver-modified habitat in the central Oregon Coast Range.

Participate in field tours, seminars, and workshops, as appropriate.

c. Planned for FY 93:

Prepare manuscript on beaver dam-site selection in central Coast Range.

Prepare manuscript on intrariparian patterns in bird communities.

Participate in field tours, seminars, and workshops as appropriate.

8. *Estimated Cost:*

	OSU
FY 92	133,000
FY 93	116,000
FY 94	118,000
FY 95	74,000
FY 96	76,000

9. *Duration of the Study:*

Initiation date:	FY 88
Scheduled completion date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Hybrid Poplar and Red Alder in Coastal Riparian Zones for Non-point Source Pollution Control, Fish and Wildlife Habitat, and Wood Fiber

2. *Principal Investigator(s) and Organization(s)*:

Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis
Dr. William H. Emmingham, Silviculturist, Department of Forest Science, OSU, Corvallis
Dr. David E. Hibbs, Silviculturist, Department of Forest Science, OSU, Corvallis
Dr. Stanley V. Gregory, Fisheries Biologist, Department of Fisheries and Wildlife, OSU, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

b. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

4. *Study Objective(s)*:

a. Monitor and measure the development of hybrid poplar and red alder established in riparian zones of streams adjacent to farm or pasture land in the Oregon Coast Range.

b. Monitor concentrations of nitrates at three depths in the soil profile across the transect of each poplar and alder buffer strip.

c. Monitor changes in bank stability and fish habitat complexity as hybrid poplar and alder stands develop.

5. *Potential Benefit or Utility of the Study*:

The best potential fish habitat in coastal Oregon is often on farmland and land near estuaries. However, in these areas bank stability, the physical configuration of fish habitat, and water quality are often in poor condition. Water quality problems related to non-point source pollution include high temperatures, high bacteria levels, and high nitrate concentrations. In Europe and the eastern United States it is well known that forest buffers can retain as much as 89 percent of the nitrogen and 80 percent of the phosphorous runoff associated with adjacent land use practices. Even narrow riparian forest strips are effective filters particularly when adjacent to cropland. Small side channels and the merger of rivers are potentially excellent salmonid habitat. However, due to past human disturbance, many of these areas are currently unproductive rearing habitat for young salmonids.

Hybrid poplar plantations are used successfully in France for fish and wildlife habitat, ground water nutrient filters, and fiber. On test plots in the Pacific Northwest, hybrid poplar can grow to over 60 feet high and attain a diameter of more than 7 inches within eight years. The French model should be tested along the Oregon Coast where, if successful, it would represent an excellent example of forest management and environmental protection resulting in better fish and wildlife habitat, cleaner rivers and bays, and an alternative high yield fiber supply. Red alder has similar potential and should also be tested. Demonstration plantations need to be started along the coast on farmland, followed by intensive sampling of ground water moving through the plantations. The demonstration sites will provide an early assessment of the length of time required to stabilize stream banks and effectively filter nutrients from ground water entering streams.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

The OSU site was replanted because of damage by beavers. A fence was constructed around the plantation to prevent further damage. A topographic map of the OSU site was made. A site near Woodburn was planted. Site at Tillamook abandoned because of excessive deer and elk browse damage.

b. Tasks Yet to Be Completed in FY 92:

Dig a dry well to monitor sub-surface water levels.

c. Planned for FY 93:

Collect and analyze growth data.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Collect and analyze growth data.

FY 1995
Collect and analyze growth data.

FY 1996
Collect and analyze growth data.

Prepare a manuscript that summarizes study results.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Participate in field tours, seminars, and workshops, as appropriate.

Write a **COPE Report** article.

c. Planned for FY 93:

Participate in field trips, seminars, and workshops, as appropriate.

8. *Estimated Cost:*

	PNW	*OSU*	*TOTAL*
FY 92	46,000	26,000	72,000
FY 93	44,000	23,000	67,000
FY 94	46,000	24,000	70,000
FY 95	37,000	27,000	64,000
FY 96	39,000	23,000	62,000

9. *Duration of the Study:*

Initiation date:	FY 89
Scheduled Completion Date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Ground Water Movement in Steep Forested Hill-Slopes with Particular Focus on Marginally Stable "Head-Walls"

2. *Principal Investigator(s) and Organization(s):*

Dr. Marvin R. Pyles, Associate Professor, Department of Forest Engineering, Oregon State University, Corvallis
Dr. Henry A. Froehlich, Professor, Department of Forest Engineering State University, Corvallis
Mr. Arne E. Skaugset, Instructor, Department of Forest Engineering and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Develop, refine, and test systems for predicting and reducing landslides, surface erosion and sediment delivery to stream channels.

4. *Study Objective(s):*

a. Review published analytical modeling methods for applicability to steep forest slope groundwater regimes.

b. Attempt measurements of the distribution of groundwater flow in a steep forested slope between saturated flow, unsaturated flow, and macro-pore or pipe flow.

c. Estimate hydraulic constants for groundwater flow in steep forest slopes.

d. Investigate site to site differences that relate to groundwater flow within a homogeneous sample of forest slopes.

5. *Potential Benefit or Utility of the Study:*

Debris avalanches from steep slopes are and will continue to be the focus of discussions about best management practices in the Oregon Coast Range. Attempts to manage forest land in such a way as to avoid the most unstable terrain are moving in the direction of quantitative assessment of slope stability as a part of the management planning process. Central in the quantitative assessment of slope stability is the pore water pressure used in the particular slope stability equation selected. This value of pore water pressure is currently obtained either by simple assumption, or from empirical ground water functions of doubtful broad geographic validity. Best assessments of slope instability will be made only if a broadly applicable groundwater model can be developed. This study is an essential first component in the development of improved ground water models.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Modified the working study plan to include a second field site. Bureau of Land Management Salem and Eugene Districts are cooperating with site selection, and will prepare the necessary environmental assessments for the second field site.

Design of piezometer system has been completed and installation is progessing. Manufacturing delays have stretched out this phase of the project.

Cooperation and support from the Oregon Dept. of Forestry has been obtained for drilling and sampling of the first field site. This was not anticipated as a requirement in the study plan, but has proven necessary given the site conditions that we have encountered.

B. Tasks Yet to be Completed in FY 92:

Complete installation of field instrumentation of the selected field study site.

Obtain and test disturbed and undisturbed soil samples from the interception trench and borings including index properties physical properties, strength, and sample permeability.

Conduct field slug tests to obtain formation permeability estimates.

c. Planned for FY 93:

Analyze data from FY 92 experiments.

Conduct field and/or laboratory experiments that are compatible with the findings of the project problem analysis and study plan.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Analyze data and prepare project reports.

7. *Publication and Technology Transfer Activities*:

a. Completed to date in FY 92:

Four hours of presentation during the Forest Road Drainage shortcourse in November 1991.

Consultation with the Roseburg District of the Bureau of Land Management regarding a landslide and potential for continued environmental damage.

b. Tasks Yet to be Completed FY 92:

Participate in seminars, workshops and field trips, as appropriate.

c. Planned for FY 93:

Participate in seminars, workshops and field trips, as appropriate.

8. *Estimated Cost*:

	OSU
FY 92	40,000
FY 93	49,000
FY 94	22,000

9. *Duration of the Study*:

Initiation Date: FY 90
Scheduled Completion Date: FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Coastal Landscape Analysis and Modeling

(Previously titled: Integration of COPE Drainage Basin Studies.)

2. *Principal Investigator(s) and Organization(s)*:

Dr. Thomas A. Spies, Research Forester, Pacific Northwest Research Station, Corvallis
Dr. Joseph E. Means, Research Forester, Pacific Northwest Research Station, Corvallis
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research
Dr. William C. McComb, Associate Professor, Department of Forest Science, Oregon State University, Corvallis
Dr. Robert L. Beschta, Professor, Department of Forest Engineering, Oregon State University, Corvallis
Dr. Gay A. Bradshaw, Research Mathematician, Pacific Nortrhwest Research Station, Corvallis
Dr. Warren Cohen, Research Forester, PNW, Corvallis
Dr. Gordon E. Grant, Research Hydrologist, Pacific Northwest Research Station, Corvallis
Dr. Stanley V. Gregory, Fisheries Biologist, Department of Fish and Wildlife, Oregon State University, Corvallis
Dr. Andrew J. Hansen, Assistant Professor, Department of Forest Science and Adaptive COPE Team, Oregon State University, Hatfield Marine Science Center, Newport

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

4. *Study Objective(s)*:

Objective 1: Coordinate and facilitate interaction among the fisheries, riparian vegetation, wildlife, and geomorphology/landslide projects of COPE with regard to conceptual approach, sampling, and data management in order to increase integration of research at the drainage basin and subregional scales.

Objective 2: Develop remote sensing tools and models to assess current vegetation composition and structure and monitor change.

Objective 3: Develop a map of the current state (1993 or 1994) of vegetation/land use/habitat conditions in the central Oregon Coast Range.

Objective 4: Determine rates and patterns of change in vegetation and land use for the period of 1983-1993, and relate these to conditions of freshwater habitat and status of stocks of anadromous salmonids in a multibasin portion of the larger study area.

Objective 5: Develop and evaluate spatial landscape models for analysis of future conditions of vegetation, fish habitat and wildlife habitat.

Objective 6: Contingent upon development of adequate models, compare alternative future scenarios of landscape condition and their implications to biodiversity and economics.

5. *Potential Benefit or Utility of the Study*:

The goal of COPE research is to find ways to enhance productivity of the multiple resources derived from streams, riparian zones, and forests of the Oregon Coast Range. This requires understanding relationships among geomorphology, stream characteristics, aquatic organisms, wildlife, and riparian and upland vegetation. Many of these components are considered in individual COPE studies, but no framework exists for integrating these studies and developing knowledge of the relationships involved.

This study will increase coordination of conceptual approaches, field sampling, data analysis, and data management. For example, we will examine factors regulating the distribution of fish and wildlife within selected drainage basins. This study will guide acquisition of a geographic information system (GIS) for COPE. This is a powerful tool for integrating landscape-scale work in several disciplines and analysis of spatial patterns of key resources.

The most important issues facing forest land managers today span a range of spatial scales from stands and streams to the subregion (e.g., Oregon Coast Range) and region (e.g., western Oregon and Washington). Changing vegetation and land use patterns have lead to changes in local, sub-regional economies, and distribution and abundance of anadromous fish and wildlife populations. The ability to rapidly assess and monitor vegetation composition and structure across large land areas will greatly benefit managers and policy makers and help inform the public.

A map of the current state (1993 or 1994) of vegetation/land use/habitat conditions in the central Oregon Coast Range would provide a visual and digital spatial model of how important aspects of ecosystem structure and composition vary across a range of scales that are important to local economies and sensitive fish and wildlife species.

An understanding of the rates and patterns of change in vegetation and land use for 1983-1993 is necessary to understand how these multibasin ecosystems arrived at their current vegetative and land use state. It can also be an important step toward interpreting changes in human, fish and wildlife communities and developing a monitoring system capable of detecting important changes in vegetation and land use.

Development and comparison of landscape models for analysis of future conditions of vegetation, fish habitat and wildlife habitat will be the vehicle for scientists to integrate their understanding of the effects of vegetation and land use changes in these multibasin ecosystems on these important response variables and identify information gaps. Comparison of alternative future scenarios of landscape condition and their implications to biodiversity and economics would provide important information for managers, policymakers and the public.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Continued analysis of Drift Creek basin patterns and associations.

Initiated examination of salmonid species diversity in Drift Creek and it relationship to channel structures, and how these change along the main stem.

Initiated examination of effects of topography, geomorphic surfaces, current vegetation and drainage pattern on occurrence of boulders and logs.

b. Tasks Yet to be Completed in FY 92:

Continue analysis of Drift Creek basin patterns and associations.

Continue examination of salmonid species diversity in Drift Creek and it relationship to channel structures, and how these change along the main stem.

Continue examination of effects of topography, geomorphic surfaces, current vegetation and drainage pattern on occurrence of boulders and logs.

c. Planned for FY 1993:

Complete analysis of Drift Creek basin patterns and associations.

Complete examination of salmonid species diversity in Drift Creek and it relationship to channel structures, and how these change along the main stem.

Complete examination of effects of topography, geomorphic surfaces, current vegetation and drainage pattern on occurrence of boulders and logs.

Begin collecting fish inventory data for Oregon Coast Range basins.

Plan and initiate sampling for ground truth of vegetation to support development of models based on remotely sensed data.

Obtain Thematic Mapper (TM) imagery of study area and begin initial processing.

Obtain ownership, topography and land use GIS layers.

d. Tasks to be Completed by Fiscal Year Starting in FY 1994:

FY 1994

Begin intensive characterization of selected multibasins.

Continue ground sampling of vegetation.

Complete first draft of vegetation/land use map.

Obtain 1983 TM imagery.

Begin analysis of vegetation and land use changes.

Begin development and comparison of landscape models of vegetation pattern and change, wildlife habitat suitability and fish habitat suitability.

FY 1995

Complete final version of vegetation/land use map.

Complete retrospective analysis of landscape change.

Continue development of landscape models.

Begin development of alternative future scenarios.

FY 1996

Complete development of landscape models.

Compare effects of alternative management scenarios on economics and biodiversity.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Presented a seminar on basin-scale patterns of fish and fish habitat in Drift Creek and their interrelationships at the Forestry Sciences Lab., Corvallis, Oregon, December 19, 1991.

Presented a poster on "Salmonid Species Diversity as Influenced by Stream Habitat and Geomorphic Surfaces in Drift Creek basin, Oregon Coast Range" at the International Association of Landscape Ecology--US Section Annual Meetings, Corvallis, Oregon, April 8-10, 1992.

b. Planned for the Remainder of FY 92:

Prepare a poster for the Ecological Society of America Meetings in August 1992.

c. Planned for FY 93:

Participate in seminars, workshops and field trips, as appropriate.

8. *Estimated Cost*:

	PNW
FY 92	245,000
FY 93	274,000
FY 94	287,000
FY 95	301,000
FY 96	316,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

The Dynamics and Silviculture of Riparian Vegetation

2. *Principal Investigator(s) and Organization(s)*:

Dr. David E. Hibbs, Associate Professor, Department of Forest Science, Oregon State University, Corvallis
Mr. Samual Chan, Plant Physiologist, Pacific Northwest Research Station, Corvallis
Dr. William H. Emmingham, Associate Professor, Department of Forest Science, Oregon State University, Corvallis
Dr. John C. Tappeiner, Professor, Department of Forest Resources, Oregon State University, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

4. *Study Objective(s)*:

a. Determine the effects of harvest entry type and intensity, landform, vegetation type, upslope activity, and time since entry on tree regeneration, understory development, and overstory dynamics (succession, mortality, windthrow, diversity) by sampling the spectrum of existing buffer strip conditions.

b. Develop systems of tree regeneration in riparian areas and descriptions of (1) how these systems affect fish and wildlife habitat characteristics and growing conditions, and (2) how these regeneration systems can be integrated into adjacent upslope management.

c. Develop the information base and methodology required to manage the riparian overstory to maintain or achieve a desired plant composition and structure through manipulation of mixes of tree and shrub species in groups of different sizes and at different densities.

Two guidelines apply to all study objectives. First, the spectrum of riparian area activities studied will range from no disturbance, through partial overstory removals, to complete harvest and will include intensive regeneration and stand management practices. Second, all characterizations of vegetation and the effects of manipulations on vegetation will be measured and described in terms useful to fisheries, wildlife and timber resource managers. Opportunities will be sought to coordinate this study with other COPE research.

5. *Potential Benefit or Utility of the Study*:

Riparian area plant communities are extremely diverse, and their structure and composition is a major determinant of fish and wildlife habitat. Likewise, the tree component can represent a sustainable source of forest products. Consequently, the management and successional dynamics of riparian area vegetation can have a major effect on the productivity of fish, timber, and wildlife resources. Unfortunately, little is known about how to manage riparian area vegetation to achieve specific habitat characteristics. Historically, management practices in riparian areas have shifted from maximum to minimum disturbance and the creation of buffer strips, primarily to protect the fisheries resource. However, in many Coast Range riparian areas, future habitat characteristics desirable for fish, timber, and wildlife may be delayed or foregone because current practices may not facilitate adequate tree regeneration and may not perpetuate desired community structure and composition.

This study will explore both the short- and long-term effects of riparian area management practices on the timber resource and on vegetation-related fish and wildlife habitat characteristics. It will provide much needed information on the growing conditions created by different silvicultural strategies and thus allow resource managers to choose appropriate methods to achieve specific vegetation characteristics in riparian areas. This will increase the resource manager's ability to eventually reach the desired mix of fish, timber, and wildlife required to meet management objectives.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Initiated chronosequence sampling of several age classes on conifer-dominated riparian zones (objective a).

Installed two permanent buffer strip riparian zone reference stands.

Completed mapping and measurement of permanent reference stand vegetation.

Completed installation of two regeneration/growing condition study sites (objective b).

Completed initial year's measurement on the first riparian regeneration/growing condition study site.

Completed mapping of alder buffer strip reference stand. Located and installed reference stand in mixed or conifer-dominated buffer strip. Worked with Adaptive COPE to develop a network of researchers and managers involved in riparian silviculture.

b. Tasks Yet to be Completed in FY 92:

Continue chronosequence work: sampling, analysis, reporting.

Continue seedling growth and physiological measurements, microsite monitoring, vegetation development, analysis, reporting.

Conduct an intensive study of the ability of different instrumentation to quantify the light environment of typical Coast Range forest types.

c. Planned for FY 93:

Continue installation of permanent riparian study sites, complete chronosequence sampling, pursue other studies of buffer strip characteristics and dynamics.

Intensify plant and microenvironmental measurements on riparian regeneration sites. Harvest selected seedlings from first regeneration site for growth analysis.

Prepare a MS thesis on light/cover assessment technology.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Continue data collection and analysis.

FY 1995
Continue data collection and analysis.

FY 1996
Complete data analysis and prepare manuscripts summarizing study results.

7. *Publication and Technology Transfer Activities*:

a. Completed to date in FY 92:

Froyd, C.A. 1992. The Effect of Riparian Buffer Strips on Salmonberry Community Structure in Alder Stands of the Oregon Coast Range. M.S. thesis, Oregon State University, Corvallis, Oregon, 121 p.

Giordano, P.A., D.E. Hibbs, and S. Chan. 1991. Vegetation Dynamics in Managed Coastal Riparian Areas. COPE Report 4(4):3-5.

Chan, S.S. 1991. Research on the Dynamics and Management Riparian Zone Vegetation. CRAFTS Technical Committee presentation.

b. Tasks Yet to be Completed in FY 92:

Prepare a manuscript summarizing first year results from riparian regeneration study.

Participate in seminars, workshops and field trips, as appropriate.

c. Planned for FY 93:

Prepare a **COPE Report** article.

Participate in workshops, seminars, and field tours, as appropriate.

8. *Estimated Cost*:

	OSU	*PNW*	*TOTAL*
FY 92	61,000	55,000	116,000
FY 93	64,000	58,000	122,000
FY 94	65,000	61,000	126,000
FY 95	66,000	64,000	130,000
FY 96	57,000	67,000	124,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Disturbance History, Channel State, Fish Habitat, and Fish Production in Sandstone Basins of the Central Oregon Coast

2. *Principal Investigator(s) and Organization(s):*

Dr. Fred H. Everest, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Mr. Lee E. Benda, Graduate Student/Staff, Department of Geological Sciences and Fishery Research Institute, University of Washington, Seattle
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s):*

Establish the spatial and temporal relationship between natural and human disturbances in central coast sandstone basins and successional state of riparian vegetation, stream channel state, fish habitat characteristics, and fish populations and community structure.

5. *Potential Benefit or Utility of the Study:*

Habitat characteristics of stream channels are influenced by riparian vegetation. The structure and composition of fish communities is in turn a function, at least in part, of habitat conditions. Little is known about changes in habitat and fish community characteristics following natural disturbance events. Even less is known about how these things change as the stream system and associated riparian zone recover over time. Knowledge of the recovery of stream systems from natural disturbance events will provide a temporal and spatial context for the management of riparian areas. This temporal and spatial context, particularly the temporal aspects, is lacking in current management schemes. This knowledge will provide a better understanding of the long-term role of riparian vegetation in stream systems and will be incorporated into riparian management schemes.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

   We completed field sampling and have made initial runs of model.

   b. Tasks Yet to be Completed in FY 92:

   Complete data analysis.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

   Used preliminary results in three presentations:

      1. Managing Forest Land for Fish Biodiversity. March 1992. Basin Inventory Workshop, U.S. Forest Service, Logan, Utah.

      2. Sediments and Fish: The need for New Perspective. February 1992. EPA/USFS Technical Workshop on Sediments, PNW, Corvallis, Oregon.

      3. Anadromous Fisheries Management. March 1992. Fish Habitat Short course, U.S. Forest Service at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

   b. Planned For Remainder of FY 92:

   Prepare a manuscript for submission to peer reviewed journal.

8. *Estimated Cost*:

	PNW
FY 92	22,000

9. *Duration of the Study*:

Initiation Date: FY 90
Scheduled Completion Date: FY 92

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Behavior of Debris Torrents and Effects on Anadromous Fish Habitat in the Oregon Coast Range

2. *Principal Investigator(s) and Organization(s)*:

Dr. Fred H. Everest, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Mr. Lee E. Benda, Graduate Student/Staff, Department of Geological Sciences and Fishery Research Institute, University of Washington, Seattle
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

c. Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.

4. *Study Objective(s)*:

a. Determine the cause, frequency, behavior, and spatial and temporal distribution of debris torrents in sandstone and basalt geologies of the Oregon Coast Range.

b. Determine the spatial and temporal effects of debris flows on the physical structure of habitat for anadromous salmonids in streams draining sandstone and basalt geologies of the Oregon Coast Range.

5. *Potential Benefit or Utility of the Study*:

Though mass wasting by debris torrents is a natural process, forest management is altering the frequency and magnitude of these events across regional landscapes in the Pacific Northwest. The problem of assessing the effects of mass wasting on channel morphology and fish habitats on scales of watersheds and over time periods of decades has never been adequately investigated, yet it is an area of great importance to resource managers.

Information on how different frequencies and magnitudes of debris torrents affect channel morphology and fish habitat will enhance the manager's ability to solve such forest management problems as identifying geomorphically-driven biological thresholds in streams, defining the degree of heterogeneity of channel morphology needed to maintain biological diversity, and designing a methodology for analysis of cumulative effects.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

All data were entered into data base.

b. Tasks Yet to be Completed in FY 92:

Continue annual field habitat surveys of Knowles Creek basin.

Analyze 10-year record of habitat changes in response to debris torrents in 1980, 1981, and 1984, in particular the persistence of channel pools and the extent of gravel accumulation created by debris torrent deposits.

Sample torrent ponds to determine fish population and structure.

c. Planned for FY 93:

Submit manuscript for publication.

Continue physical habitat field work.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Examine the link between distribution of juvenile anadromous salmonids in stream sub-basins and physical habitat changes caused by debris torrents.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Used preliminary results in five presentations.

1. Sediments and Fish: The Need for a New Perspective. February 1992. EPA/USFS Technical Workshop on Sediments, Pacific Northwest Research Station, Corvallis, Oregon.
2. Alternatives in Management of Fish Habitat in the Pacific Northwest. February 1992. Oregon Chapter of American Fisheries Society, Bend, Oregon.
3. Managing for Fish Biodiversity in Pacific Northwest Streams. October 1991. Fish Habitat Shortcourse, Colorado State University, Ft. Collins, Colorado.
4. Owls, Fish, Timber, and Forest. February 1992. Oregon Business Council.
5. Fish in the Pacific Northwest, November 1991. A dialogue with Senator Bob Packwood and the Natural Resources Staff.

b. Planned for Remainder of FY 92:

Prepare a manuscript for peer reviewed journal.

c. Planned for FY 93:

Participate in field trips, seminars, and workshops, as appropriate.

8. *Estimated Cost*:

	PNW
FY 92	22,000
FY 93	23,000
FY 94	24,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Estimation of Smolt Production from Lobster Creek Study Basin

2. *Principal Investigator(s) and Organization(s):*

Dr. Fred H. Everest, Research Fish Biologist, Pacific Northwest Research Station Corvallis
Dr. Stanley V. Gregory, Associate Professor, Department of Fish and Wildlife, Oregon State University, Corvallis
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s):*

a. Quantify salmonid smolt (juvenile migrants physiologically adapted for ocean existence) production from the Lobster Creek basin, including numbers, size, community structure, and timing of migration.

b. Relate production and behavior of smolts to land use activities in riparian and upland areas of the basin.

5. *Potential Benefit or Utility of the Study:*

Land management activities such as timber harvest and road construction can affect the physical configuration of stream habitats for anadromous salmonids. Changes in habitat can affect survival of young salmonids at various life history stages and result in ecological changes that favor one species over another.

Changes in fish community structure are likely to follow if changes in habitat persist. While any life stage in the egg, embryo, alevin, fry, parr, smolt sequence can be affected by freshwater habitat changes, those changes that reduce smolt production are the most crucial to viability of a species. It is possible, however, for a species to suffer losses in egg, alevin, fry, and parr survival without affecting smolt production. This is especially true for species (e.g., anadromous trouts) with extended fresh water rearing periods.

To accurately assess the affects of land management practices on salmonid production in a stream subbasin, it is essential to quantify spatial and temporal changes in habitat and relate those changes to the number of smolts produced annually. The relationship between habitat and smolt production is not well documented for streams in the Oregon Coast Range. COPE basin studies offer the opportunity to couple land management, fish habitat, and salmonid smolt production in a way that will help to isolate the habitat factors that are most sensitive to change and are most likely to limit a given salmonid species.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Preliminary data analysis has been completed.

b. Tasks Yet to be Completed in FY 92:

Analysis of FY 91 data.

c. Planned for FY 93:

Complete final data analysis.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

None. This study will be completed in FY 93.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remaining of FY 92:

Prepare a report summarizing data from 1990 and 1991 from multi-institutional research team.

c. Planned for FY 93:

Prepare a final report of study results.

8. *Estimated Cost*:

	PNW
FY 92	17,000
FY 93	18,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 93

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Ecology and Habitat Relationships of Selected Riparian-Associated Wildlife

2. *Principal Investigators and Organizations*:

Dr. Robert G. Anthony, Assistant Leader, Oregon Cooperative Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis

Dr. E. Charles Meslow, Leader, Oregon Cooperative Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis

Dr. William C. McComb, Associate Professor, Departments of Forest Science and Fisheries and Wildlife, Oregon State University, Corvallis

Advisory Personnel:

Dr. Joseph J. Beatty, Director, Biology Program, Biology Department, Oregon State University, Corvallis

Dr. Stanley V. Gregory, Associate Professor, Department of Fisheries and Wildlife, Oregon State University, Corvallis

Dr. Andrew Hansen, Assistant Professor, Department of Forest Science and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport

Dr. David Hibbs, Associate Professor, Department of Forest Science, Oregon State University, Corvallis

Dr. Thomas A. Spies, Research Forester, Pacific Northwest Research Station, Corvallis

Dr. John C. Tappeiner, Professor, Department of Forest Resources Management, Oregon State University, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

4. *Study Objectives*:

   a. Describe habitat relationships of selected riparian-associated wildlife.

   b. Describe diets and reproductive fitness of selected riparian-associated wildlife.

   c. Identify the important resources (food, water, habitat) that explain association to riparian areas.

5. *Potential Benefit or Utility of the Study*:

   Riparian zone management is increasingly scrutinized by State and Federal agencies and the public, and associated wildlife are one of the important resources in these management considerations. Research is currently underway to identify species of vertebrates that are closely associated with riparian areas, but no information is available on the extent of these associations nor the riparian resources which constitute any dependencies. Recent controversies over the new Forest Practices Rules and the lack of ecological information on riparian-associated wildlife makes the need for this information a high priority. This study will provide a data base upon which wildlife/forest management in riparian zones can be improved. Specifically, the study will identify the area and key resources (food, water, microhabitats, etc.) important to selected species (e.g., river otter, beaver, mink, marsh shrew, great-blue heron, bald eagles, kingfishers, etc.) that could be sensitive to riparian management. We will work closely with other COPE scientists to develop information for enhanced integrated resource management in riparian areas.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

      A detailed study plan for John Loeggrings, Ph.D., project has been completed along with coursework. Ten study streams have been selected for the project, and methods of sampling have been determined.

   b. Tasks Yet to be Completed in FY 92:

      Activities in FY 92 will include project planning, and fieldwork (spring and summer). Intensive fieldwork will be conducted from April through September of 1992. Ph.D. student plus one field assistant will conduct the field studies.

   c. Planned for FY 93:

      Continuation of intensive field work.

   d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Continuation of intensive field work.

Data analysis.

Completion of Ph.D.

Initiation of additional projects/studies.

FY 1995
Intensive field work on additional studies.

FY 1996
Data analysis and report write-up.

Prepare manuscripts for publication.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Participate in field tours, seminars, and workshops as appropriate.

c. Planned for FY 93:

Participate in field tours, seminars, and workshops as appropriate.

8. *Estimated Cost*:

	OSU
FY 92	28,000
FY 93	45,000
FY 94	48,000
FY 95	50,000
FY 96	52,000

9. *Duration of the Study*:

Initiation Date:	FY 91
Scheduled Completion Date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

The Utilization of Unconstrained Stream Reaches by Salmonids in the Oregon Coast Range

2. *Principal Investigators and Organizations*:

Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis

Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s)*:

Synthesize data from the Oregon Coast Range which encompasses channel reach types. Specifically the proportion of broad valley flats and their relative utilization by salmonids.

5. *Potential Benefit or Utility of the Study*:

Unconstrained reaches on wide valley flats have been shown in previous COPE research to be extremely productive and important refuges for different species and age classes of salmonids. Many stream habitat surveys and fish population estimates have been undertaken by several agencies in the last few years or are currently underway. No attempt has been made to examine this data from the point of view of fish species, age class and location in the basin of unconstrained reaches. A synthesis of this data would allow us to determine how much the Elk River case study can be extrapolated to other geologies and latitudes in the Oregon Coast Range. If the results hold up, the product of the research would be to aid managers in identifying high priority areas for fish habitat restoration.

6. *Research Activities:*

   a. Accomplishments to Date in FY 92:

      Habitat and fish populations were surveyed in basin. Smolt output was monitored at two locations in river.

   b. Tasks Yet to be Completed in FY 92:

      Southern Oregon coast data analysis and synthesis.

   c. Planned for FY 93:

      Central Oregon Coast data analysis and synthesis.

   d. Tasks to be Completed by Fiscal Year Starting in FY 94:

      FY 1994
      North Oregon Coast data analysis and synthesis.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

      Used data in five presentations:

      1. Anadromous Fisheries Management. March 1992. Fish Habitat Short-course, USFS at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

      2. Managing Forest Land for Fish and Biodiversity. March 1992. Basin Inventory Workshop, U.S. Forest Service, Logan, Utah.

      3. Alternatives for Managing Owls, Old Growth, and Fish. February 1992. Annual Meeting of California Salmon and Steelhead Restoration Federation, Redding, California.

      4. Consideration of Salmonid in Forest Planning. April 1992. Analyst's Meeting, U.S. Forest Service Regions 5 and 6, Sacramento, California.

      5. An Ecosystem Approach to Conservation and Management of Freshwater Habitat for Anadromous Salmonids in the Pacific Northwest. March 1992. North American Wildlife and Natural Resources Conference, Charlotte, North Carolina.

b. Planned for the Remainder of FY 92:

Prepare **COPE Report** articles and present results at workshops.

Participate in field tours and seminars as appropriate.

Prepare a manuscript that summarizes study results to date.

c. Planned for FY 93:

Participate in field trips, seminars, and workshops, as appropriate.

8. *Estimated Cost*:

	PNW
FY 92	9,000
FY 93	8,000
FY 94	8,000

9. *Duration of Study*:

Initiation Date:	FY 92
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Evaluation of Anadromous Salmonid Habitat Restoration Program on Schooner Creek, Hebo Ranger District, Siuslaw National Forest

(This study was intitiated in 1990. Because of the study's relevance to riparian zone management in the Oregon Coast Range and associated research tasks identified in item 3, this study will become COPE-sponsored research starting in FY 92).

2. *Principal Investigators and Organizations*:

Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis
Dr. Gordon H. Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Mr. Robert Metzger, Siuslaw National Forest
Mr. Carl McLemore, Hebo Ranger District, Siuslaw National Forest
Mr. Mario Salozzi, Research Division, Oregon Department of Fisheries and Wildlife, Corvallis, Oregon
Mr. Ron Rhew, Adaptive COPE, Newport, Oregon
The Northwest Steelheaders, Lincoln City Chapter, Lincoln City, Oregon

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s)*:

a. Document and quantify physical changes in summer and winter habitats for steelhead trout, coastal cutthroat trout, coho salmon, and chinook salmon resulting from habitat rehabilitation in the South Fork of Schooner Creek.

b. Quantify response of juvenile anadromous salmonids to changes in summer and winter habitat.

c. Quantify changes in smolt production resulting from habitat rehabilitation.

d. Quantify numbers and species of adult salmonids returning to the South Fork of Schooner Creek.

e. Evaluate the cost-effectiveness of the overall rehabilitation program.

5. *Potential Benefit or Utility of the Study*:

The Siuslaw National Forest and the Oregon Department of Fish and Wildlife are engaged in a systematic program to restore and enhance habitats of anadromous salmonids in streams in the Oregon Coast Range including the South Fork of Schooner Creek. The Oregon Department of Fish and Wildlife and PNW Research Station are actively engaged in a systematic effort to evaluate the results of salmonid habitat rehabilitation programs in coastal Oregon. The Northwest Steelheaders are interested in restoration of steelhead stocks to provide improved angling opportunities. The COPE program is actively involved in research and education programs to maintain and enhance the productivity on Oregon's Coast Range resources.

The methods and techniques for habitat restoration are still in the developmental stage, and the physical, biological, and economic benefits of habitat restoration and enhancement are not completely understood. The accessibility and uniqueness of the Schooner Creek evaluation project have considerable educational and demonstration value to resource managers and the public in regard to the design and relative effectiveness of various fisheries habitat restoration and enhancement activities.

6. *Research Activities*:

a. Accomplished to Date in FY 92:

We operated traps to enumerate smolt numbers and surveyed habitat and fish in late summer. Data was entered into data base but no analysis has been done.

b. Tasks Yet to be Completed in FY 92:

Quantify returning adult salmonids and quantify smolt production from the basin.

Determine changes in physical habitat in summer and winter and the response of juvenile salmonids to such changes.

Complete detailed study plan.

c. Planned for FY 93:

Objectives a. - e. above

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994 - 1996
Objectives a. - e. above.

Make preliminary estimates of the cost-effectiveness of the overall rehabilitation program.

FY 1996
Prepare a manuscript that summarizes study results.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for the Remainder of FY 92:

Prepare **COPE Report** articles and present results at workshops.

Participate in field trips and seminars as appropriate.

Publish study results.

c. Planned for FY 93:

Participate in field trips, seminars and workshops as appropriate.

8. *Estimated Cost:*

	PNW
FY 92	18,000
FY 93	46,000
FY 94	48,000
FY 95	50,000
FY 96	53,000

9. *Duration of the Study:*

Initiation Date: FY 92
Scheduled Completion Date: FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions

Pending discussion at the June 2, 1992 COPE Advisory Council meeting, resources allocated to this study will be shifted to the proposed study "Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range" in order to accommodate changes in Adaptive COPE research.

2. *Principal Investigators and Organizations*:

Dr. Loren D. Kellogg, Associate Professor, Department of Forest Engineering, Oregon State University, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas.

b. Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.

c. Identify and integrate associations among ecosystem components in riparian areas and explain their ecological relationships.

d. Test and compare harvesting systems that enable managers to achieve various states of fish and wildlife habitat and levels of timber production in riparian areas.

4. *Study Objective(s)*:

a. Identify the logging planning and layout requirements for a replicated set of experimental timber harvest treatments in headwater basins which represent a gradient of levels and/or spatial distributions of structural retention (live trees, snags, fallen trees).

b. Identify and evaluate operational constraints of implementing harvest treatments relative to logging feasibility and human safety.

c. Quantify logging production and costs associated with harvest treatments.

5. *Potential Benefit or Utility of the Study:*

It is important that forest operations are adequately considered when evaluating response of multiple forest resources to alternative silvicultural prescriptions. There are many logging constraints associated with steep terrain and cable operations in the Oregon Coast Range. Non-traditional silvicultural prescriptions must be evaluated for feasibility and cost. Unfortunately, little economic information is available even on more recent riparian management practices, and no information is available regarding new proposed prescriptions. In addition, worker safety associated with strategies aimed at developing forest structure is an area of concern by the timber industry. Given the forest management challenges of today and tomorrow, there are certainly opportunities for practicing some new silvicultural prescriptions in the Oregon Coast Range. For a complete identification and evaluation of these prescriptions, information needs to be obtained and presented concerning operational logging issues as well as other multiple forest resource issues.

This study will contribute to the overall success of Adaptive COPE by interacting with other scientists and providing guidance in selecting sites and conducting harvesting treatments from the perspective of operational feasibility. It will also provide much needed information on logging planning, worker safety and economics associated with different silvicultural strategies. This operational information can then be used in conjunction with other soil, water and wildlife information for a complete evaluation of alternative silvicultural prescriptions in headwater basins. This comprehensive analysis and synthesize approach will provide information to the resource manager to help choose appropriate methods to meet multiple forest resource objectives. At the same time, the resource manager will know harvesting cost tradeoffs and operational requirements for implementation.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Worked with Adaptive COPE team and other scientists to identify sites and methods for accomplishing multidisciplinary research. The focus is on active management in riparian zones and upslope harvesting with different timber retention levels.

b. Tasks Yet to be Completed in FY 92:

Prepare a draft study plan. Work with Adaptive COPE team and cooperators in selecting study sites, and making arrangements for the implementation of harvest treatments (logging planning and layout).

Work with COPE team on appropriate technology transfer activities (harvesting component).

c. Planned for FY 93

Installation of treatments. Harvesting data collection for study objectives a, b and c.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Installation of treatments. Harvesting data collection for study objectives a, b and c.

FY 1995
Data analysis and reporting of results.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Kellogg, L., S. Pilkerton and R. Edwards. 1991. Logging Requirements to Meet Alternative Silviculture Prescriptions. **COPE Report** 4(3):8-11.

b. Planned for the Remainder of FY 92:

Present results at COPE workshops and other appropriate meetings, contribute to appropriate newsletter articles and site tours organized by Adaptive COPE leaders.

c. Planned for FY 93:

Participate in field trips, seminars and workshops, as appropriate.

8. *Estimated Cost*:

	OSU
FY 92	64,000
FY 93	67,000
FY 94	70,000
FY 95	73,000

9. *Duration of the Study:*

Initiation Date:	FY 92
Scheduled Completion Date:	FY 95

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Strength Behavior of Forest Soils Under True Field Stresses

2. *Investigators and Organizations*:

Dr. J. Richard Bell, Professor, Department of Civil Engineering, Oregon State University, Corvallis (Principal Investigator)
Dr. Warren L. Schroeder, Associate Dean of Engineering, College of Engineering, Oregon State University, Corvallis (Study Consultant)
Dr. Marvin R. Pyles, Associate Professor, Department of Forest Engineering, Oregon State University, Corvallis (Associate Investigator)

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Develop, refine, and test systems for predicting and reducing landslides, surface erosion and sediment delivery to stream channels.

4. *Study Objective(s)*:

a. Review published information on residual soils and soil strength theories and testing procedures especially as related to soils under low ambient stress levels.

b. Design and construct strength testing apparatus and procedures for low stress testing and stress path control.

c. Test laboratory prepared specimens under stress conditions that simulate actual stresses in steep forested or recently logged slopes.

d. Test typical natural soils to obtain a preliminary evaluation of the range and variability of the controlling strength parameters.

e. Document the equipment, procedures, and results and present results at COPE workshops and appropriate conferences.

5. *Potential Benefit or Utility of the Study*:

In recent years there has been a major effort to apply the theories of soil mechanics to the problem of shallow landslides on the steep forested slopes of the Pacific Northwest. Even though these techniques have been successful in civil engineering applications their application to forested slopes has been disappointing. Since the methods of analysis often have been proven elsewhere, it is believed the difficulty is with the input data - especially soil strength data.

For most civil engineering works the ambient stresses in the soils are relatively higher than in the forested slopes. Also, engineering construction usually increases total stresses. In the forest soil slope, failures are usually the result of reductions of effective stress at essentially constant total stress. Standard test equipment and procedures are designed for the civil engineering applications and nearly all information in the literature is based on research with this equipment.

Tests at higher stresses may overwhelm and thereby obscure the factors that control behavior at low stresses. Some low stress tests have been performed by forest engineering researchers at OSU, but they were performed with increasing total stress loading and they leave many questions unanswered. It is the purpose of this study to conduct a detailed laboratory study of typical forest soils subjected to stress paths (loading conditions) true to those developed in the steep forested slopes of the Pacific Northwest.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Performed preliminary literature survey, prepared detailed study plan draft, and began test equipment designs and modifications.

b. Tasks Yet to be Completed in FY 92:

Continue literature review, complete design of test apparatus, and construct and test equipment.

c. Planned for FY 93:

Complete equipment and test procedures development, select test soils, perform tests on laboratory prepared samples to evaluate effects of differences between equipment types and procedures.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Collect and test natural soil samples.

FY 1995
Complete tests, prepare publications, and present results.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for the Remainder of FY 92:

Document instrumentation and procedures.

c. Planned for FY 93:

Present preliminary results of comparisons of test methods at appropriate workshops and at a regional conference.

8. *Estimated Cost:*

	OSU
FY 92	51,000
FY 93	33,000
FY 94	35,000
FY 95	37,000

9. *Duration of the Study:*

Initiation Date:	FY 92
Scheduled Completion Date:	FY 95

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Integrating and Managing Recreation with Other Resources

2. *Principal Investigators and Organizations:*

Dr. Perry J. Brown, Professor, Department of Forest Resources, Oregon State University, Corvallis
Dr. George H. Stankey, Senior Research Professor, Department of Forest Resources, Oregon State University, Corvallis
Dr. Roger Clark, Program Manager, Pacific Northwest Research Station, Seattle

The project will be undertaken within the structure of the Consortium on Social Values of Natural Resources, of which all three investigators are members of the Board of Directors.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

This study encompases both the riparian and reforestation management issues.

4. *Study Objective(s):*

   a. Determine what is known about management of recreation relative to sustainability and to other resource uses.

   b. Develop a conceptual framework for understanding how recreation can be integrated with other resource uses.

   c. Develop guidelines for management of recreation which is integrated with other resource uses and which considers resource sustainability.

5. *Potential Benefit or Utility of the Study:*

Resource management often has been divided into functional areas which pit one resource use against another and which lead to competition among managers of different resource functions. We now are moving into an era where recognition of the complementary relationship among many resource uses is recognized and valued. Simply, in many cases joint production of resource outputs is possible and desirable. Some forms of recreation, timber, wildlife, and grazing management (and outputs) particularly fit this situation. Additionally, a recognition of the need to ensure sustainability of resources is a major tenet of the current resource management paradigm. What this suggests is that we need to find ways to do joint production while ensuring resource sustainability. Specifically, we need to synthesize what we know about integrating recreation with other resource uses, particularly timber and wildlife, and develop guidelines for integrating recreation with these other resource uses.

This study will involve developing a conceptual framework for considering recreation in integrated resource management. It will involve synthesizing what we now know about joint production which includes recreation and it will involve developing guidelines for recreation management in an integrated and sustainable resource management system. Thus, it will provide much needed information about how to manage the recreation resources of Oregon's coastal forests such that resources can be sustained and multiple social values served.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

A draft study plan has been prepared and research planning is nearly completed.

b. Tasks Yet to be Completed in FY 92:

Complete detailed study plan, begin to formulate framework for analysis (objective b), and complete majority of literature review (objective a). Identify a team of managers who will assist in development of guidelines (objective c).

c. Planned for FY 93:

Draft a publication which lays out the conceptual framework (objective b) and interprets the literature (objective a) relative to that framework. Begin to meet with managers to formulate recommended management guidelines (objective c).

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Complete formulation of management guidelines (objective c) and develop a publication which reports the guidelines.

7. *Publication and Technology Transfer Activites*:

a. Completed to Dated in FY 92:

None.

b. Planned for the Remainder of FY 92:

Present results at COPE workshops or other appropriate meetings; prepare newsletter articles; possibly establish a demonstration site; publish two documents as reports (noted above FY 1993, FY 1994).

c. Planned for FY 93:

Present results at COPE workshops or other appropriate meetings; prepare newsletter articles; possibly establish a demonstration site; publish two documents as reports (noted above FY 1993, FY 1994).

8. *Estimated Cost*:

	OSU
FY 92	27,000
FY 93	28,000
FY 94	29,000

9. *Duration of the Study:*

Initiation Date:	FY 92
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Socioeconomic Research Feasibility Study

2. *Principal Investigators and Organizations*:

Dr. Steven E. Daniels, Assistant Professor, Department of Forest Resources, Oregon State University, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

This study encompasses both the riparian and reforestation management issues.

4. *Study Objective(s)*:

a. Inventory the existing research and development/assistance efforts related to the study region and issue.

b. Determine the relevant geographic scale for considering socioeconomic issues in the Oregon Coast Range. (Can you understand the socioeconomics of coastal Oregon without understanding the region's relationship to the Willamette Valley populations?)

c. Develop an information base and technology to access and incorporate expertise and values of local communities related to socioeconomic issues.

d. Develop a set of potential research programs that address socioeconomic issues in the relevant region.

e. Design a forum where researchers and various stakeholders could discuss the potential research programs and rank them in terms of feasibility or desirability.

5. *Potential Benefit or Utility of the Study*:

Socioeconomics is a broad concept that captures many of the ways people interact with natural resources. It is also a topic that COPE has not focused on to date. Any COPE research into socioeconomics must be carefully designed if it is to be both technically feasible and produce useful knowledge. Research planning for this endeavor is especially important, given the large number of other agencies and organizations that are either gathering data or actively assisting rural communities. Without careful planning, it would be easy to duplicate other efforts, or conduct research on a policy issue that is being resolved in another venue.

This study will systematically examine the socioeconomic situation in the Oregon Coast Range to identify research projects that are both desirable and feasible. Special efforts and techniques will be used to combine the knowledge of both university researchers and local stakeholders who hold important expertise.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Inventory of information is 75 percent complete.

Scale of research and soft systems method selected as research approach.

b. Tasks Yet to be Completed in FY 92:

All objectives described in section 4 (above).

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for the Remainder of FY 92:

Prepare a final report that outlines research options. Present results at COPE workshops or other appropriate meetings.

8. *Estimated Cost:*

	OSU
FY 92	25,000

9. *Duration of the Study:*

Initiation Date:	FY 92
Scheduled Completion Date:	FY 92

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Ecology and Management of Shrubs and Hardwoods in Coastal Forests

2. *Principal Investigator(s) and Organization(s)*:

Dr. John C. Tappeiner, Professor, Department of Forest Resources, College of Forestry, OSU, Corvallis
Dr. John C. Zasada, Research Forester, Pacific Northwest Research Station, Corvallis
Dr. Steven R. Radosevich, Professor, Department of Forest Science, College of Forestry, OSU, Corvallis

This work will be coordinated with riparian zone studies.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

a. Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

b. Examine the economics of the above-mentioned strategies and assess the economic impacts of constraints on fire and herbicides.

4. *Study Objective(s)*:

Develop guidelines and techniques for managing the major shrub and hardwood species in the forests of coastal Oregon by:

a. relating their potential rates of vegetative reproduction to the size and vigor of their aerial and/or underground parts;

b. determining the effect of common silvicultural treatments (logging, burning, cutting) on vigor and density of vegetation reproduction;

c. determining their rates of reproduction and growth from seed and sprouts in a range of environments common in clearcuts and in young and old stands.

5. *Potential Benefit or Utility of the Study*:

Currently, foresters manage nonconiferous vegetation in the Coast Range to enhance conifer growth and to provide wildlife habitat. However, they do so with little information on the reproduction and growth habits of shrubs and hardwoods. At what stage of succession do shrubs and hardwoods become established? What environments favor their establishment, and what are their growth rates following reproduction from seed, from vegetative reproduction, and following burning and other silvicultural treatments? How can establishment and growth be predicted? At what age and in what environments do they produce seed? How does interspecific competition affect succession and species composition? With answers to these questions, foresters will be better able to make site-specific prescriptions to produce wildlife habitat and to enhance conifer growth. Zasada and Tappeiner have begun seedling growth and survival studies on salal, bigleaf maple, vine maple, thimbleberry, and elderberry. Tappeiner has completed studies on vegetative and seedling reproduction of tanoak and madrone. Radosevich has begun studies on the seedling establishment and vegetative growth of thimbleberry and salmonberry. Maxwell and Radosevich have also begun development of population growth models for these species which includes the influence of intra- and inter-specific competition on demographic parameters and lateral spread from rhizomes. These models will provide a means of assessing the influence of management practices on salmonberry and thimbleberry. Thus collectively, with this research, we will be able to make a substantial step toward answering the questions posed for these major species.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

We measured the response of salmonberry clones to cutting in the understory of alder stands. The results reported earlier continue to hold up. That is that cutting two consecutive years in June caused a substantial reduction in salmonberry cover and height. Two growing seasons after two cuttings cover was less than 15 percent compared to 80 percent on plots which received only one cutting .

Evaluation of vine maple clone sprouting was completed. On three sites, branches which were pinned to the ground while attached to the clone; all rooted the first year. Branches severed from the clone, and cut did not sprout. Thus slashing vine maple branches during thinning or clearcutting will prevent clonal spread, but not kill vine maple cones.

b. Tasks Yet to be Completed in FY 92:

Continue monitoring salal seedling establishment and clonal development.

Measure salmonberry response to control in alder understory.

Continue monitoring bigleaf maple response to pretreatment control and overstory removal.

Complete analysis of vine maple clone data.

Complete analysis of vine maple bud bank study.

Post-harvest evaluation of shrub survival and sprouting on root rot study plots.

Continue monitoring bigleaf maple sprouting control study.

Begin monitoring the response of shrubs and hardwoods to three different cutting methods.

c. Planned for FY 93:

Monitor response of salmonberry to understory treatment.

Monitor response of bigleaf maple to preharvest control.

Follow data on salal seedling and clone development in thinned stands.

Complete data analysis on these studies.

Analyze effects of three different harvest methods on vegetation dynamics.

Continue re-evaluation of post-harvest plots.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Data analysis.

Continue re-evalution of post-harvest plots.

Manuscript preparation.

FY 1995
Data analysis and manuscript preparation.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Prepared a draft manuscript on riparian shrub ecology.

Prepared a paper on seedling shrub establishment and submitted it to the editors.

b. Tasks Yet to be Completed in FY 92:

Prepare an article on vine maple for the **COPE Report**.

Prepare an M.S. Thesis on vine maple conal ecology.

Participate in field tours, seminars, and workshops as appropriate.

c. Planned for FY 93:

Prepare manuscript on vine maple clonal ecology.

Prepare manuscript on salal ecology.

Complete manuscript on cutting salmonberry understory in alder stands.

8. *Estimated Cost*:

	OSU	*PNW*	*TOTAL*
FY 92	38,000	55,000	93,000
FY 93	40,000	58,000	98,000
FY 94	41,000	24,000	65,000
FY 95	43,000	25,000	68,000

9. *Duration of the Study*:

Initiation date:	FY 87
Scheduled completion date:	FY 95

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Characterization of the Thermal Environment for Developing Guidelines to Manage Shrubs and Hardwoods in Coastal Forests

2. *Principal Investigator(s) and Organization(s)*:

Dr. Roger D. Ottmar, Acting Project Leader, Pacific Northwest Research Station, Seattle

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

4. *Study Objective(s)*:

a. Characterize the humus layer and soil thermal environment (depth of heat penetration, intensity, and duration) from broadcast burns in coastal forests.

b. Develop a thermodynamic heat transfer model based on the relationship between woody fuel load, humus load, live vegetation load, lighting method, fuel moisture, soil moisture, and soil heat transfer properties.

5. *Potential Benefit or Utility of the Study*:

One of the benefits from prescribed fire is the short-term control of certain plant species which will improve the establishment and survival of tree seedlings. Through the heating of the humus and soil layers by fire, the roots, rhizomes, and buried seeds of unwanted weed species are affected. However, most vegetation succession studies have described the vegetation response without documentation of the fire and the humus and soil thermal environment which created the response.

This study will provide the thermal environment characterization and modeling that is a critical element in development of guidelines for managing the major shrub and hardwood species in the forests of coastal Oregon, the chief objective of the companion study.

The heat intensity, duration, and penetration into the humus and soil layer generated by broadcast burning logging debris is the critical variable determining the overall effectiveness of fire for controlling undesirable vegetation. Modeling the heat transfer process using variables which managers can easily acquire will allow preharvest and prescribed fire planning to best control vegetation and mitigate the effect of fire on air, soil, and water resources.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Discussed heat pulse model development with INT.

Selected 2 units for heat pulse meansurements.

Earlier data analysis indicates major variables for heat pulse duration include woody fuel and duff consumption, soil moisture, and soil type.

b. Tasks Yet to be Completed in FY 92:

Inventory, burn, and monitor 2-4 units specific to the needs of filling data gaps. Work closely with Missoula Fire Lab to simplify selected heat pulse model for operational use by managers. Model will use variables available to managers.

c. Planned for FY 93:

Complete final analysis of heat pulse and fuel consumption data. Finalize heat pulse model and prepare joint publication with Missoula Fire Lab.

Transfer knowledge to land managers through formal training sessions and workshops.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Discuss heat pulse model at technical fire management training and Forest level planning session.

Discussed heat pulse measurement techniques for use in characterizing fire for determining effect on yew seedling germination.

b. Planned for Remainder of FY 92:

Prepare an article for the **COPE Report**.

Provide instruction at a Regional level training session, Technical Fire Management, and two Forest-level fuel planning sessions.

Participate in field tours, seminars, and workshops, as appropriate.

c. Planned for FY 93:

Provide instruction at a Regional level training session, technical fire management, and two Forest level fuel planning sessions.

8. *Estimated Cost:*

	PNW
FY 92	53,000
FY 93	39,000

9. *Duration of the Study:*

Initiation date:	FY 87
Scheduled completion date:	FY 93

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Second Decade Effects of Site Preparation on Tree and Vegetation Development With and Without Precommercial Thinning

2. *Principal Investigator(s) and Organization(s):*

Dr. William I. Stein, Research Forester, Pacific Northwest Research Station, Corvallis
Dr. Peyton W. Owston, Project Leader, Pacific Northwest Research Station, Corvallis
Dr. John C. Zasada, Research Forester, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

a. Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

b. Examine the economics of the above-mentioned strategies and assess the economic impacts of constraints on fire and herbicides.

c. Identify the effects of prescribed fire on long-term site productivity and develop methods to reduce adverse impacts.

4. *Study Objective(s):*

Determine the extended effects of reforestation practices on the growth of trees and associated vegetation with or without precommercial thinning by:

a. Comparing tree survival and growth during the second decade following different site preparation treatments.

b. Determining changes in vegetative cover, height, and animal use as conifers close crowns with or without precommercial thinning.

c. Quantifying the effects of precommercial thinning on stand growth, vegetative development, and animal use.

5. *Potential Benefit or Utility of the Study*:

Substantial information is available on the short-term effects of different reforestation practices on survival and growth of conifers and the development of associated vegetation in coastal forests but very little on the duration of these effects as crowns close and intraspecific competition becomes a prominent factor. Precommercial thinning is also practiced extensively, but its effects on early growth in plantations and the development of associated vegetation has not been quantified. The scheduled duration of two studies in which site preparation treatments were compared side-by-side for a decade on the Siuslaw National Forest is just ending. Large differences are evident due to treatments and to tree protection by tubing.

It is important to learn whether these differences continue as stands close and what effect precommercial thinning has on both stand development and vegetation associated with each treatment. The two studies, totaling 10 replications, are large enough to accommodate a thinning treatment within the framework of the original design. They represent one of the few opportunities to follow the effects of reforestation practices on a longer-term basis where both trees and associated vegetation are monitored to learn the interrelated effects of treatment on both timber and wildlife.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Summarized 10th-year tree and vegetation data for all four sites of the Coastal Site Preparation study. Ten-year tree survival and growth trends continue to show the same differences among site preparation treatments as shown by 7th-year results.

Designated plots and make baseline size measurements on thinned and unthinned trees at Poposchultz.

Completed baseline vegetation survey at Poposchultz; also, selected and thinned trees.

b. Tasks Yet to Be Completed in FY 92:

Remeasure vegetation transects at Pitchfork - 16th year.

Remeasure tree diameters and heights at Pitchfork - 16th year.

c. Planned for FY 93:

Remeasure vegetation transects at Beaver and Upperten - 16th year.

Remeasure vegetation transects in all 4 units of the Coastal site preparation study - 13th year.

Remeasure tree diameters and heights at Beaver and Upperten - 16th year.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Remeasure vegetation transects at Randall and Poposhultz - 16th year.

Remeasure tree diameters and heights at Randall and Poposhultz - 16th year.

FY 1995
Remeasure vegetation transects at Pitchfork - 19th year.

Remeasure tree diameters and heights at Pitchfork - 19th year.

Work on data analysis.

FY 1996
Remeasure vegetation transects at Beaver and Upperten - 19th year.

Remeasure vegetation transects in all 4 units of the Coastal Site Preparation Study - 16th year.

Remeasure tree diameters and heights at Beaver and Upperten - 19th year.

Remeasure tree diameters and heights in all 4 units of the Coastal Site Preparation Study - 16th year.

Complete data analysis.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Prepare a progress report for the **COPE Report**.

c. Planned for FY 93:

Publication summarizing 10-year tree survival and growth and vegetation development in Coastal Site Preparation Study.

8. *Estimated Cost*:

	PNW
FY 92	44,000
FY 93	39,000
FY 94	41,000
FY 95	43,000
FY 96	45,000

9. *Duration of the Study*:

Initiation date:	FY 89
Scheduled Completion date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Species Manipulation as a Strategy to Reduce the Impact of Laminated Root Rot in Regenerated Coastal Stands

2. *Principal Investigator(s) and Organization(s)*:

Dr. Walter G. Thies, Research Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

Develop and test ways of reducing root rot damage in new plantations.

4. *Study Objective(s)*:

a. Identify the relative susceptibility of coastal Oregon conifers to laminated root rot.

b. Determine if the number of nonsymptomatic-diseased trees in a stand is correlated to the number of symptomatic trees.

c. Measure the minimum inoculum size that can cause seedling mortality.

d. Determine if the size and condition of stumps left on the site can be successfully used to predict seedling mortality due to laminated root rot in the regenerated stand.

5. *Potential Benefit or Utility of the Study*:

Laminated root rot is responsible for significant losses in the Oregon Coast Range. Using data from recently completed surveys by state and federal agencies we conservatively estimate that there are 300,000 acres of openings in the forests of the Oregon Coast Range caused by laminated root rot, with a nearly equal area populated by infected live trees. This is land out of production but it is also land on which up to $500 per acre is being spent for site preparation and planting which will not result in a harvestable stand. Losses are more severe in northern counties than in southern counties. Using the above survey data, we estimated that Columbia County is experiencing a 50 percent production short-fall on 32 percent of the commercial forest land.

Douglas-fir is very susceptible to laminated root rot yet it occupies large areas of commercial forests in the Oregon Coast Range. Use of valuable but more resistant conifers could increase economic yield on infested forest lands, with relatively little additional investment. However, at this time, a verified ranking of commercial conifer species by their susceptibility to laminated root rot is not available. Data on susceptibility to infection and yield of various species on infested sites is an essential prerequisite to recommending reforestation with alternate conifers on traditional Douglas-fir sites.

To develop an ability to predict laminated root rot losses in a replacement stand we need to determine the size of roots that can serve as effective inoculum and the frequency of nonsymptomatic infected trees in an uncut stand.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

On Study Area One, conducted plot maintenance to include replanting where needed.

On Study Area Two, planted seedlings on the site and checked survival in the fall.

b. Tasks Yet to be Completed in FY 92:

On Study Area Three, complete all inoculum mapping, cut the stand, locate all "undisturbed inoculum" plots, install reburied inoculum plots, and collect and rebury 500 pieces of inoculum.

Locate Study Area Four, and inititate pre-cut inoculum mapping.

c. Planned for FY 93:

Continue plot maintenance on Study Areas One and Two.

Replant as needed in Study Area Two.

Plant Study Area Three and check survival in the fall.

On Study Area Four, complete all inoculum mapping, cut the stand, locate all "undisturbed inoculum" plots, install reburied inoculum plots, and collect and rebury 500 pieces of inoculum.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Collect and Analyze seedling mortality from inoculum rebury plots on Study Area One.

Continue plot maintenance on Study Area Two and Three.

Replant Study Area Three as needed.

Plant seedlings on Study Area Four, and check mortality in the fall.

FY 1995
Study Area One: collect mortality data from both inoculum rebury plots and from undisturbed plots. Tag and map seedlings on undisturbed plots.

Study Area Two: collect and analyze data from inoculum rebury plots.

Study Area Three: plot maintenance.

Study Area Four: plot maintenance, replant as needed.

FY 1996
Study Area One: collect mortality data from all plots.

Study Area Two: collect mortality data on all plots. Tag and map seedlings on undisturbed plots.

Study Area Three: collect and analyze data from inoculum rebury plots.

Study Area Four: plot maintenance,.

Prepare a manuscript reporting the correlation between symptomatic diseased trees and nonsymptomatic diseased trees.

Prepare a report describing inoculum size and condition required to initiate infection.

Prepare a report on the relationship of residual infected stump size to mortality of nearby seedlings due to laminated root rot.

Final reports: summary paper of species susceptability information based on inoculum-rebury plots in Study Area One, Two, and Three.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Participate in field tours, seminars, and workshops, as appropriate.

c. Planned for FY 93:

Participate in field tours seminars, and workshops, as appropriate.

8. *Estimated Cost:*

	PNW
FY 92	150,000
FY 93	124,000
FY 94	61,000
FY 95	68,000
FY 96	66,000

9. *Duration of the Study*:

Initiation date:	FY 89
Scheduled Completion date:	FY 96

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Asymbiotic Nitrogen Fixation in Large Woody Residues of Oregon Coastal Forests

2. *Principal Investigator(s) and Organization(s):*

Dr. C.Y. Li, Research Microbiologist, Pacific Northwest Research Station, Corvallis
Dr. Randy Molina, Project Leader, Pacific Northwest Research Station, Corvallis
Ralph Crawford, Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

Identify the effects of prescribed fire on long-term site productivity and develop methods to reduce adverse impacts.

4. *Study Objective(s):*

a. To provide baseline information on the amount of nitrogen fixation by free living bacteria in large woody debris on the forest floor before and after tree harvest.

b. To determine the influence of mycorrhizae on nitrogen fixation rates in large woody debris in coastal Oregon forests.

c. To provide information to reforestation specialists on the impact of large woody debris removal on long-term nitrogen economy of Oregon coastal forests.

5. *Potential Benefit or Utility of the Study:*

Woody residues are conspicuous features of the forest floor in coastal Oregon forests. They provide habitat for plants, animals, and a diversity of microorganisms. Nitrogen fixation by free living (asymbiotic) bacteria in large woody debris is known to input small but significant amounts of nitrogen into Rocky Mountain Douglas-fir forests. Large woody debris also serve as active refugia for roots and mycorrhizae. Recent research by our group has shown a close association between certain mycorrhizae of forest trees and free living nitrogen-fixing bacteria. Information is badly needed on the degree of nitrogen fixation occurring in large woody debris in coastal Oregon forests and the influence of resource management practices (e.g. removal or burning of large woody debris) on long-term accretion of nitrogen via these mechanisms.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

The $^{15}N_{12}$ study with large woody debris under low oxygen concentrations indicates that nitrogen fixation in wood debris occurs more rapidly under microaerophilic conditions than under aerobic conditions. Previous studies by other workers using aerobic conditions may have given lower nitrogen estimation for the wood debris nitrogen fixation.

b. Tasks Yet to be Completed in FY 92:

None.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Presented a poster for the symposium on Minority Participation in Forestry and Fishery-related Sciences: A Need, A Goal, A Commitment. Vol. 6-9, 1991. Huntsville, Alabama.

Asymbiotic Biological Nitrogen Fixation Associated with Coarse Woody Debris Residue of Oregon Coastal Forests. Ching Y. Li, Ralph Crawford, and Randy Molina.

b. Planned for Remainder of FY 92:

Complete and submit manuscript.

Prepare an article for the **COPE Report**.

Participate in field tours, seminars, and workshops, as appropriate.

8. *Estimated Cost:*

	PNW
FY 92	16,000

9. *Duration of the Study:*

Initiation date:	FY 89
Scheduled Completion date:	FY 92

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Characterization of Trichoderma spp.: Prelude to Biological Control

2. *Principal Investigator(s) and Organization(s)*:

Dr. Earl E. Nelson, Research Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

Develop and test ways of reducing root rot damage in new plantations.

4. *Study Objective(s)*:

a. Collect and identify *Trichoderma* spp. associated with root pathogens.

b. Characterize isolates using isozyme analyses and related technology.

c. Test promising isolates for biological control potential.

5. *Potential Benefit or Utility of the Study*:

Laminated root rot (*Phellinus weirii*) and other root diseases of western conifers greatly reduce yields on many thousands of acres in western Oregon. Annual loss to *P. weirii* alone in western United States has been estimated at 4.4 million cubic meters of timber. Root diseases not only reduce tree growth and cause mortality, but keep valuable forest lands out of production by their continued presence as facultative saprophytes in roots and butts of killed or harvested trees. Consequently, regeneration of these areas to Douglas-fir or other susceptible conifers is doomed to failure, unless these pathogens are removed from the site or effectively eliminated by chemical or biological controls.

Inoculations with isolates of *Trichoderma* spp. into stumps infested with *P. weirii* have resulted in colonization by those inoculants, and have presumably reduced the viability of the pathogen in those parts of the stumps colonized. Tests of antagonism of *Trichoderma* spp. against *Armillaria luteobubalina* (Nelson et al. 1989) appear to work equally well with *Trichoderma* spp. against *P. weirii*, but these tests, using colonized stem wood sections, are time consuming. Isozyme analysis of isolates of *Trichoderma* spp. appears to be a useful means of characterizing specific isolates as an aid in taxonomic classification, and perhaps as a means of "finger printing" specific isolates. In addition, this and other techniques can be used to probe for specific attributes pointing toward effective biological control or competitive colonization of pathogen-infested substrates.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

   Approximately 1200 *Trichoderma* isolates have been collected and stored in liquid nitrogen. Over 500 of these have been identified to species and 120 of those tested for antagonism to *Phellinus weirrii*.

   b. Tasks to be Completed in FY 92:

   Continue collections of *Trichoderma* isolates and identify them to species.

   Continue antagonism testing using technique reported in 7th International Conference on Root and Butt Rots. (Proceedings published 1989).

   Publish on new *Trichoderma* spp. in late FY 92 or early 93. Two or possibly 3 new species have been isolated from wood and soil.

   c. Planned for FY 93:

   Continue collections of *Trichoderma* isolates and identify them to species.

   Continue antagonism testing using technique reported in 7th International Conference on Root and Butt Rots. (Proceedings published 1989).

   d. Tasks to be Completed by Fiscal Year Starting in FY 94:

   FY 1994
   Prepare comprehensive paper on *Trichoderma* spp. and their potential for biological control of *P. weirii*.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

   None.

   b. Planned for Remainder of FY 92:

Participate in seminars, workshops, and field trips as appropriate.

c. Planned for FY 93:

Participate in seminars, workshops, and field trips, as appropriate.

Prepare manuscript: "*Trichoderma* spp. Occurring in Fumigated Living Douglas-Fir."

8. *Estimated Cost*:

	PNW
FY 92	17,000
FY 93	18,000
FY 94	19,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Rate of Spread of Phellinus weirii in Living vs Dead Root Systems

2. *Principal Investigator(s) and Organization(s):*

Dr. Earl E. Nelson, Research Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

Develop and test ways of reducing root rot damage in new plantations.

4. *Study Objective(s):*

To determine if development of *P. weirii* is restricted in root systems of harvested trees.

5. *Potential Benefit or Utility of the Study:*

Phellinus weirii (Murr.) Gilb. (laminated root rot) is the most damaging root disease in the northwestern United States and British Columbia. Annual losses are estimated at 4.4 million cubic meters. Once established in a stand, the disease spreads along root systems, passing from tree to tree when an infected root contacts a healthy root. Spread along living root systems increases the radius of infection centers about 34 cm/year. Spread of the fungus after death of the host may be limited by competition from other microorganisms, at least after the first year, but growth in living vs. dead trees has not been objectively compared.

Recent attempts to model important root diseases in the west (including *P. weirii*) have pointed to information gaps in numerous areas. Spread of the fungus along living roots to expand infection centers during the life of a stand has been established, but spread after harvest (or stand destruction by other means) and, consequently, area of potential inoculum in the succeeding stand are not known. If spread along dead roots continues (at rates different from or similar to those measured in living trees), then areas of potential inoculum some years after stand harvest can be estimated accordingly.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

Harvested first one-third of living and dead trees and cultured from dissected root systems.

b. Tasks Yet to be Completed in FY 92:

Analyze data from first harvest.

The second sampling of stumps and roots for *P. weirii* is planned for August 1992, depending on results of 1991 data analysis.

c. Planned for FY 93:

The final sampling of stumps and roots for *P. weirii* is planned for August 1993.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Complete data analysis and publication preparation.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Participate in seminars, workshops, and field trips as appropriate.

c. Planned for FY 93:

Participate in seminars, workshops, and field trips, as appropriate.

8. *Estimated Cost:*

	PNW
FY 92	9,000
FY 93	13,000
FY 94	3,000

9. *Duration of the Study:*

Initiation Date:	FY 90
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title:*

Chemical Control of Phellinus (Poria) weirii Part III--Application of Chloropicrin or Methyl Isothiocyanate (MS) to Live Infected Trees

2. *Principal Investigator(s) and Organization(s):*

Dr. Walter G. Thies, Research Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

Develop and test ways of reducing root rot damage in new plantations.

4. *Study Objective(s):*

a. Determine if either healthy or diseased (*P. weirii* infested) Douglas-fir can survive injection of chloropicrin or MS at dosages approaching those previously shown to eradicate *P. weirii* from stumps.

b. Determine if when trees receiving sublethal dosages of fumigant are harvested how completely *P. weirii* been eliminated from the stump and roots.

c. For those trees that die as a result of injecting the fumigants, determine if the fumigant eradicated *P. weirii* from the stump and root system.

d. At sublethal dosages, determine what the impact is on diameter growth of non-infected and infected trees injected with chloropicrin or MS.

e. Examine the impact on non target organism populations around trees treated with chloropicrin or MS.

5. *Potential Benefit or Utility of the Study:*

Laminated root rot, caused by *Phellinus weirii*, affects all species of commercially important conifers in the Oregon Coast Range. When infected trees die, the pathogen continues to live saprophytically in dead roots for 50 years or more. Infection in a young stand begins when roots of young trees contact residual infested stumps and roots from the preceding stand. The fungus spreads between living trees through root contact and may take 25 years to kill a second growth Douglas-fir. Regenerating Douglas-fir or other highly susceptible species on a site infested with *P. weirii* nearly always results in continuation of the disease and subsequent losses in the new stand.

Laminated root rot is responsible for significant losses in the Oregon Coast Range. Using data from recently completed surveys by state and federal agencies we conservatively estimate that there are 300,000 acres of openings in the forests of the Oregon Coast Range caused by laminated root rot, with a nearly equal area populated by infected live trees. This is land out of production but it is also land on which up to $500 per acre is being spent for site preparation and planting which will not result in a harvestable stand. Losses are more severe in northern counties than in southern counties. Using the above survey data, we estimated that Columbia county is experiencing a 50 percent production short-fall on 32 percent of the commercial forest land.

Phellinus weirii causes the most serious root disease problem facing land managers in the Pacific Northwest. Evidence suggests that chloropicrin or methyl isothiocyanate (MS) can be used to eradicate *P. weirii* from stumps and roots. Additional evidence suggests that live Douglas-fir at least tolerate injection of fumigants into their root collars. This study will test the hypothesis that chloropicrin or MS can be injected into Douglas-fir at some dosage that will not adversely affect growth of the host while eradicating *P. weirii* or ameliorating its impact on the host.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

      Completed all field work associated with examination of nontarget organisms.

      Completed approximately 80 percent of lab analysis and identification work associated with nontarget organisms.

   b. Tasks Yet to be Completed in FY 92:

      Complete lab work and analyze data.

      Publish at least one on the manuscripts associated with the work.

   c. Planned for FY 93:

      Complete analysis of nontarget organism data and prepare manuscripts.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Prepare a manuscript for publication.

Participate in seminars, workshops and field trips, as appropriate.

c. Planned for FY 93:

Prepare three manuscripts.

8. *Estimated Cost*:

	PNW
FY 92	85,000
FY 93	20,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 93

May 1992

Fundamental COPE
Progress Report

1. *Title*:

The Influence of Tree Vigor on Infestation of Douglas-fir by Phellinus weirii

2. *Principal Investigator(s) and Organization(s)*:

Dr. Everett M. Hansen, Associate Professor, Department of Botany & Plant Pathology, Oregon State University, Corvallis
Dr. Ellen Michaels Goheen, Plant Pathologist, Forest Pest Management, USDA Forest Service, Region 6, Portland
Dr. Walter G. Thies, Research Plant Pathologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

Develop and test ways of reducing root rot damage in new plantations.

4. *Study Objective(s)*:

a. Determine if tree vigor as influenced by inter-tree competition, affects susceptibility to laminated root rot.

b. Determine if seedling vigor as affected by light and nutrient availability, affects susceptibility to laminated root rot.

5. *Potential Benefit or Utility of the Study*:

Laminated root rot, caused by *Phellinus weirii*, affects all species of commercially important conifers in the Oregon Coast Range. When infected trees die, the pathogen continues to live saprophytically in dead roots for 50 years or more. Infection in a young stand begins when roots of young trees contact residual infested stumps and roots from the preceding stand. The fungus spreads between living trees through root contact and may take 25 years to kill a second growth Douglas-fir. Regenerating Douglas-fir or other highly susceptible species on a site infested with *P. weirii* nearly always results in continuation of the disease and subsequent losses in the new stand.

Laminated root rot is responsible for significant losses in the Oregon Coast Range. Using data from recently completed surveys by state and federal agencies, it has been conservatively estimated that there are 300,000 acres of openings in the forests of the Oregon Coast Range caused by laminated root rot, with a nearly equal area populated by infected live trees. This is land out of production but it is also land on which up to $500 per acre is being spent for site preparation and planting which will not result in a harvestable stand. Losses are more severe in northern counties than in southern counties. Using the above survey data, it has been estimated that Columbia County is experiencing a 50 percent production short-fall on 32 percent of the commercial forest land.

It has been hypothesized that trees become susceptible to root rot only when growing under stress. Stressed trees must allocate scarce resources to minimal growth requirements, and have nothing left over for the "luxury" of producing defense compounds. If true, then silvicultural treatments to increase tree vigor should render trees resistant to *Phellinus weirii*.

We will test the hypothesis directly by inoculating trees of high and low Waring vigor index with the laminated root rot fungus and later measuring infection, and extent of colonization. The study will be established on plots in both the Oregon Coast Range and in the Cascade Range; however, this report deals only with the effort being made in the Oregon Coast Range.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

      All field work has been completed.

      Data analysis has been nearly completed.

   b. Tasks Yet to be Completed in FY 92:

      Complete evaluation of data.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

      None.

   b. Planned for Remainder of FY 92:

      Give a presentation at the National Phytopathology meeting.

      Conduct tours and participate in workshops, as appropriate.

      Prepare a manuscript for publication.

8. *Estimated Cost:*

	PNW
FY 92	11,000

9. *Duration of the Study:*

Initiation Date:	FY 90
Scheduled Completion Date:	FY 92

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Identification of Potential Brush and Hardwood Problem Sites

2. *Principal Investigator(s) and Organization(s)*:

Dr. Don Minore, Plant Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

4. *Study Objective(s)*:

a. Describe and measure areas on which unusually intensive vegetation management is required to control shrubs and hardwoods that compete with conifer regeneration after timber harvest, stratifying the areas by site preparation treatment.

b. Describe and measure areas on which little vegetation management is required to control the shrubs and hardwoods that compete with conifer regeneration after timber harvest, stratifying the areas by site preparation treatment.

c. Correlate important preharvest site characteristics with the range of postharvest shrub and hardwood competition identified under objectives a and b.

d. Formulate a preharvest identification key to potential postharvest shrub and hardwood problems.

5. *Potential Benefit or Utility of the Study*:

Shrub and hardwood competition is a major problem in regenerating conifers in the Oregon Coast Range. Salmonberry, thimbleberry, vine maple, alder, bigleaf maple, and a host of other competing species often occupy harvested areas and preempt the light, moisture, and nutrients needed by young conifer seedlings. Shrub and hardwood competition tends to be erratic and unpredictable, however, and areas differ with respect to the amount and vigor of postharvest shrub and hardwood growth that they support. Some areas require intensive, expensive treatments if planted conifers are to survive and grow; on others little vegetation control is needed. Unfortunately, it is often difficult to predict the postharvest response of shrubs and hardwoods before harvest occurs on a given area, and problem areas cannot be reliably identified in advance.

An ounce of prevention is worth a pound of cure in forestry as well as medicine, and applying preventive measures or allocating available resources in advance to known brush and hardwood problem areas before they are harvested is more economical and efficient than waiting until after harvest to see if a problem develops on any given area. A guide to the identification of potential brush and hardwood problem sites is needed. This study should provide that guide.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Data were analyzed from the field work done in 1991.

b. Tasks Yet to be Completed in FY 92:

Relocation and measurement of plots on harvested sites.

This work will not be possible if logging is precluded by northern spotted owl regulations.

c. Planned for FY 93:

Remeasurement and analyses of harvested stands.

d. Tasks to be Completed by Fiscal Year Starting in FY 94:

FY 1994
Remeasure and analyses of harvested stands.

Conduct summary analyses.

Prepare a manuscript summarizing study results.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

A preliminary publication summarizing preharvest stand data will be prepared. Those data are not dependent on logging.

Participate in seminars, workshops, and field trips, as appropriate.

c. Planned for FY 93:

Participate in seminars, workshops, and field trips, as appropriate.

8. *Estimated Cost*:

	PNW
FY 92	55,000
FY 93	58,000
FY 94	61,000

9. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 94

May 1992

Fundamental COPE
Progress Report

1. *Title*:

Decision Support System for Reforestation in the Oregon Coast Range

2. *Principal Investigators and Organizations*:

Dr. Lauri Shainsky, Research Ecologist, Pacific Northwest Research Station, Portland
Dr. Steve Knowe, Assistant Professor, Department of Forest Science, Oregon State University, Corvallis
Mr. Pat Cunningham, Statistician, Pacific Northwest Research Station, Corvallis
Dr. Tim Harrington, Assistant Professor, Department of Forest Science, Oregon State University, Corvallis
Dr. Steve Radosevich, Professor, Department of Forest Science, Oregon State University, Corvallis

Other significant contributors who will participate as their time permits:

Don Minore, PNW Research Station, Corvallis.
Mike Newton, OSU College of Forestry, Corvallis.
John Tappeiner, OSU College of Forestry, Corvallis.
Pete Owston, PNW Research Station, Corvallis.
Bob Shula, OSU College of Forestry, Corvallis.
Gabe Tucker, OSU College of Forestry, Newport.
Bill Emmingham, OSU College of Forestry, Corvallis.
Steve Hobbs, OSU College of Forestry, Corvallis.
Dave Hibbs, OSU College of Forestry, Corvallis.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range.

Develop and test strategies for reforestation that will be effective whereever coastal forests grow, even with constraints on prescribed fire and herbicides.

4. *Study Objective(s)*:

a. Compile and evaluate information available on biotic and abiotic factors (including pre- and post-harvest variables) affecting survival and early growth of conifer and hardwood regeneration. PNW scientists will take the lead in this objective.

b. Develop an expert system for defining and evaluating reforestation alternatives for the Oregon Coast Range. OSU scientists will take the lead in this objective.

5. *Potential Benefit or Utility of the Study*:

Reforestation is a critical step in forest management in the Oregon Coast Range. The reforestation stage is so critical that many alternatives have been tested and a large amount of knowledge obtained both through research and operational experience. However, much of this information is not readily available to land managers and researchers for the purpose of identifying and evaluating regeneration alternatives for a given site within the framework of ecological, environmental, and political constraints. The accessibility of this information is particularly important because of limitations to the use of historically valuable tools such as fire and herbicides.

We propose the development of two parallel tools for use by managers and researchers which will allow maximum accessibility to historical information on reforestation alternatives in the Coast Range and evaluation of those alternatives for a given site. The first tool is a computer-based bibliography of reforestation information from the Coast Range. The second tool is a computer based expert system designed to integrate information accessed from the above-mentioned bibliography with known site history and conditions to formulate and customized reforestation alternatives for the site. The new information on site conditions then becomes part of the information base which can be used in the future on the given site for further alternative formulation and evaluation at the later stages of the reforestation process, as well as on similar sites for alternative formulation and evaluation.

This system is an expansion of the concept behind the VEGPRO system developed by the CRAFTS program at Oregon State University for evaluating vegetation management alternatives. However, this system would incorporate a broader perspective of forest management, thus requiring a broader information base and more decision criteria, and be more closely tied to pre-and post-harvest site and stand conditions.

There are a number of research projects under way on which this project would draw heavily for published and unpublished information. These include a several CRAFTS projects which deal with various aspects of modeling and young stand development. In addition there are fundamental and adaptive COPE projects which will provide important information.

Expert systems are also able to incorporate operational information into the decision making and evaluation process. This information would be gathered from public agencies and private companies and be an important part of the data base for the project.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

None.

b. Tasks to be Completed in FY92:

Write a detailed study plan.

Begin literature search and information gathering.

Evaluate best methods for developing expert system.

c. Planned for FY93:

Continue literature search and development of computer based bibliography.

Begin development of expert system.

d. Tasks to be Completed by Fiscal Year Starting in FY94:

FY 1994
Literature search; develop bibliography; develop expert system.

FY 1995
Continue development of bibliography and expert system.

FY 1996
Test and refine expert system and decision base.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY92:

None.

b. Planned for the Remainder of FY92:

Participate in field trips, seminars, and workshops, as appropriate.

c. Planned for FY93:

Participate in field trips, seminars, and workshops, as appropriate.

8. *Estimated Cost:*

	PNW	*OSU*	*TOTAL*
FY 92	50,000	30,000	80,000
FY 93	53,000	31,000	84,000
FY 94	56,000	32,000	88,000
FY 95	59,000	33,000	92,000
FY 96	62,000	34,000	96,000

9. *Duration of Study:*

Initiation Date:	FY 92
Scheduled Completion Date:	FY 96

LIST OF PROGRESS REPORTS FOR FY 1992
ADAPTIVE COPE STUDIES AND TECHNOLOGY TRANSFER ACTIVITIES

Page

I. *Riparian Zone Management*

A. Modeling Root Reinforcement in Shallow Forest Soils (Arne Skaugset, Marv Pyles, and Jim Schroeder, OSU) 104

B. The Role and Management of Large Woody Debris for Fish Habitat in Coast Range Streams (Arne Skaugset, Ron Rhew, and Bob Beschta, OSU; Gordon Reeves and Jim Sedell, PNW) 107

C. Establishment and Growth of Conifers Under Existing Riparian Vegetation (Gabe Tucker, Mike Newton and Barbara Schrader, OSU; Mike Cloughesy, Douglas County Extension Service; Ralph Duddles, Coos and Curry Counties Extension Service; Steve McConnell, University of Idaho) 109

D. Active Management of Riparian Zones for Multiple Resources: II. Release of Suppressed and Intermediate Conifers in Alder-Dominated Riparian Zones of the Oregon Coast Range (Gabe Tucker, Barbara Schrader, Eric Horvath, and Doug Bateman, OSU; Steve McConnell, University of Idaho) 113

E. Active Management of Riparian Zones for Multiple Resources: III. Influence of Woody Debris Piece Size on Function in Small Streams (Bob Bilby, Weyerhaeuser; Arne Skaugset, Jim Schroeder, and Ron Rhew, OSU; James Sedell, PNW) 117

F. Stability Assessment of End-Haul Disposal Areas (Arne Skaugset, Marvin Pyles and Jim Schroeder, OSU; Dave Michael, Keith Mills and John Seward, Oregon Dept. of Forestry) 121

G. Interdisciplinary Research and Demonstration Area (IRDAP) (The Adaptive COPE Team, OSU) 124

Page

II. *Reforestation in the Oregon Coast Range*

A. A Synthesis of Reforestation Practices with Constraints on Fire and Herbicides (Gabe Tucker, William Emmingham, and Steve Hobbs, OSU) 129

B. Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes (Andy Hansen, OSU) 132

C. Adaptation of a Forest Succession and Wildlife Habitat Model to Managed Coast Range Forests (Andrew Hansen, Steve Garman, and William McComb, OSU; Martin Raphael, PNW; Dean Urban, University of Virginia; Barry Noon, PSW) 135

D. Effects of Forage Seeding on Establishment and Growth of Douglas-fir Seedlings (Tim Harrington and Gabe Tucker, OSU; Steve McConnell, University of Idaho) 139

III. *Technology Transfer Activities* 142

May 1992

Adaptive COPE
Progress Report

1. *Title*:

Modeling Root Reinforcement in Shallow Forest Soils

2. *Principal Investigator(s) and Organization(s)*:

Mr. Arne E. Skaugset, Hydrologist, Adaptive COPE Team, OSU, Hatfield Marine Science Center, Newport
Dr. Marvin R. Pyles, Associate Professor, Department of Forest Engineering, OSU, Corvallis
Mr. James Schroeder, Hydrology Research Assistant, Adaptive COPE Team, OSU, Hatfield Marine Science Center, Newport

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.

4. *Study Objective(s)*:

a. Develop an analytical model of the root reinforcement mechanism.

b. Determine the relationship between soil strain and rupture for a continuum of simulated root biomasses using a physical model.

c. Verify model results in the field.

5. *Potential Benefit or Utility of the Study*:

Landslides are the dominant erosional process in the Oregon Coast Range. If excessive sediments become entrained in and/or settle out on streambed gravels, hatching and emergence of salmonid fry may be impaired. More transport resistant sediment can cause stream aggradation which may change the form of and impair the function of the aquatic habitat.

One of the possible causes of accelerated erosion following harvesting is associated with the effect of clearcut silviculture on slope stability. It is hypothesized that the increase in slides is caused, in part, by the decay of harvested tree roots. This hypothesis is based on the concept that the strength of shallow forest soils on steep slopes is due, in part, to reinforcement by roots. When trees are harvested and their roots decay, a reduction in soil strength results. Regeneration of the stand will establish new roots, but a window will exist between harvest and complete regeneration when root reinforcement will be at a minimum. If the reduction in root reinforcement is large enough, and if a storm of the sufficient magnitude to cause slides occurs during this window, accelerated erosion caused by increased landsliding may occur.

There are numerous questions remaining concerning the role of roots in stabilizing steep slopes. Research is needed to quantify the extent of root reinforcement in natural and managed forest areas. Slope stability models exist which require data input concerning root strength and at present, there is not an adequate basis for assigning accurate values for this variable. The goal of this research project is to develop a model that will allow the determination of the magnitude of potential root reinforcement. This will allow for the comparison of the magnitude of root reinforcement with other soil strength parameters so a determination can be made of the importance of root reinforcement at a site.

To better manage the steep forested slopes of the Coast Range, land managers will need to have an increasing knowledge of the actual failure mechanism in shallow forest soils. This research will help develop a detailed understanding of the failure mechanism and in particular the mechanism of root reinforcement.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92

      None.

   b. Tasks Yet to Be Completed in FY 92:

      Develop and refine the analytical model.

   c. Planned for FY 93:

      Prepare a manuscript that summarizes study results.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

      None.

   b. Planned for Remainder of FY 92:

      Prepare a manuscript on the analytical model.

c. Planned for FY 93:

Present a seminar on Analytical Model Results.

Prepare a **COPE Report** article.

8. *Duration of the Study*:

Initiation date:	FY 89
Scheduled Completion date:	FY 93

May 1992

Adaptive COPE
Progress Report

1. *Title:*

The Role and Management of Large Woody Debris for Fish Habitat in Coast Range Streams

2. *Principal Investigator(s) and Organization(s):*

Mr. Arne Skaugset, Hydrologist, Adaptive COPE Team, Oregon State Univ., Hatfield Marine Science Center, Newport
Mr. Ron Rhew, Research Assistant, Department of Forest Engineering and Adaptive COPE Program, OSU, Hatfield Marine Science Center, Newport
Dr. Robert L. Beschta, Professor, Forest Engineering Department, OSU, Corvallis
Dr. Gordon Reeves, Research Fish Biologist, Pacific Northwest Research Station, Corvallis
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

4. *Study Objective(s):*

a. Synthesize current information relative to the abundance, distribution, and composition of large woody debris and fish populations in Oregon Coast Range streams of varying size and management history.

b. Quantify the relationship between large woody debris and riparian vegetation composition and structure.

5. *Potential Benefit or Utility of the Study:*

Although the importance of large woody debris (LWD) as fish habitat is now well-established, a number of key questions remain as how best to protect and maintain LWD in watersheds managed for timber production or how to manage riparian zones where past practices led to substantial reductions in LWD. These questions are: What is the relationship between amount and quality (species, size, shape, and stability) of debris and fish production? What are the characteristics of debris (distribution, abundance, composition) and associated fish populations in streams flowing through different aged forest stands? What streamside management prescriptions will provide the appropriate types of debris to the stream and in the proper quantities? Answers to these questions are necessary for evaluating the effectiveness of the current Forest Practices Act, for proper placement and design of instream structures to mimic the function of LWD in debris impoverished streams, and for effective management of riparian zones to ensure production of large woody debris over the long-term.

The first step in answering these questions will be to review available published and unpublished information, with particular reference to the Oregon Coast Range. Such an effort will provide managers with a useful synthesis of current information distribution, size, and composition of LWD in forest streams of various management histories and sizes. This synthesis will focus on ways to adapt this information into management strategies for protecting and enhancing fish habitat. The synthesis would also aid in refining hypotheses to be tested in further field research.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

None. Study terminates in FY 92.

b. Tasks Yet to Be Completed in FY 92:

None. Study terminates in FY 92.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

McMahon, T., and R. Rhew. 1991. A Large Woody Debris Data Base for Coast Range Streams. **COPE Report** 4(3):3-5.

b. Planned for Remainder of FY 92:

Complete a study report.

8. *Duration of the Study*:

Initiation date:	FY 89
Scheduled Completion date:	FY 92

May 1992

Adaptive COPE
Progress Report

1. *Title:*

Establishment and Growth of Conifers Under Existing Riparian Vegetation

2. *Principal Investigator(s) and Organization(s):*

Dr. Gabe Tucker, Assistant Professor, Adaptive COPE Team and Department of Forest Science, Oregon State University, Corvallis
Ms. Barbara Schrader, Research Assistant, Oregon State University, Department of Forest Science and Adaptive COPE
Mr. Steve McConnell, Silviculture Research Assistant, University of Idaho, Moscow, Idaho
Mr. Mike Cloughesy, Douglas County Forestry Extension Agent, Roseburg
Mr. Ralph Duddles, Coos and Curry Counties Forestry Extension Agent, Coquille
Dr. Mike Newton, Professor, Department of Forest Science, OSU, Corvallis

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

4. *Study Objective(s):*

a. Quantify survival of conifer seedlings planted under riparian vegetation subjected to overstory and understory manipulation.

b. Quantify growth (height and diameter) of conifer seedlings planted under riparian vegetation subjected to overstory and understory manipulation.

c. Quantify browse damage on protected and unprotected seedlings planted under riparian vegetation subjected to overstory and understory manipulation.

d. Quantify disposition of vexar tubes placed on seedlings planted under riparian vegetation subjected to overstory and understory manipulation.

e. Determine which treatment combinations used, by species, result in the best establishment of coniferous regeneration under riparian vegetation.

5. *Potential Benefit or Utility of the Study*:

In this study growth response and survival of four species of conifers planted under riparian vegetation subjected to overstory and understory manipulation are quantified. This information will provide insight into the effort that must be expended, and the silvicultural strategies that must be used, to obtain coniferous regeneration by planting into riparian forests.

The current Forest Practices Act contains regulations designed to enhance fish habitat, including the retention of conifers in riparian management areas which may eventually serve as woody debris in streams. Because of past natural and man-caused disturbances many riparian areas are dominated by a red alder overstory and a brush understory (principally salmonberry). There are few conifers in many of these stands and limited potential for natural conifer regeneration. Active management to reestablish conifers in these areas may restore the structures and functions desired from riparian vegetation and enhance fisheries and wildlife resources as well as provide timber for harvest.

Strategies for conifer establishment in riparian areas are untested. Emmingham et al. showed that planted hemlock seedlings can survive and grow under upland alder stands and that growth was enhanced by thinning some of the overstory alder. The thinning was done by chemically girdling trees, leaving some shade from standing dead timber. This study will compare killing all or a portion of the overstory trees by both chemically and manually girdling trees, as well as controlling understory vegetation by chemical and manual means. Results will offer insight into the nature of the manipulations of riparian vegetation necessary to create conditions suitable for successful growth of different species of conifer regeneration.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Measured end of growing season growth and survival, damage, and tube disposition.

Analyzed second-year results.

Significant differences in height growth were detected according to site, overstory treatment, species, and tubing effects. Differences in diameter growth were detected according to site, overstory treatment, understory treatment, and species and tubing interations.

b. Tasks Yet to Be Completed in FY 92:

Measure winter browse damage and disposition of vexar tubes (May 1992).

Quantify midsummer cover over planted seedlings (July 1992).

c. Planned for FY 93:

Measure end of growing season growth and survival, damage, and tube dispostion (October 1992).

Analyze 3rd year results (Winter 1992-93).

Measure winter browse damage and disposition of vexar tubes (May 1993).

Quantify midsummer cover over planted seedlings (July 1993).

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

FY 1994
Measure end of growing season growth and survival, damage, and tube dispostion (October 1993).

Analyze 4th year results (Winter 1993-4).

Measure winter browse damage and disposition of vexar tubes (May 1994).

Quantify midsummer cover over planted seedlings (July 1994).

FY 1995
Measure end of growing season growth and survival, damage, and tube dispostion (October 1994).

Analyze 5th year results (Winter 1994-5).

Measure winter browse damage and disposition of vexar tubes (May 1995).

Quantify midsummer cover over planted seedlings (July 1995).

FY 1996
Measure end of growing season growth and survival, damage, and tube dispostion (October 1995).

Analyze 6th year results (Winter 1995-6).

Measure winter browse damage and disposition of vexar tubes (May 1996).

Quantify midsummer cover over planted seedlings (July 1996).

Complete final data collection, analyze, and provide a draft publication.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

Presented paper on Riparian Silviculture at Reforestation Committee Session of Western Forestry and Conservation Association Meeting, December 3-6, 1991, Victoria, B.C.

b. Planned for Remainder of FY 92:

Prepare **COPE Report** article on second-year results.

Participate in field tours, seminars, and workshops as appropriate.

c. Planned for FY 93:

Prepare an article for the **COPE Report**.

8. *Duration of the Study*:

Initiation date: FY 89
Scheduled Completion date: FY 96

May 1992

Adaptive COPE
Progress Report

1. *Title*:

Active Management of Riparian Zones for Multiple Resources: II. Release of Suppressed and Intermediate Conifers in Alder-Dominated Riparian Zones of the Oregon Coast Range

2. *Principal Investigator(s) and Organization(s)*:

Dr. Gabriel Tucker, Assistant Professor, Department of Forest Science and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport, Oregon

Ms. Barbara Schrader, Research Assistant, Department of Forest Science and Adaptive COPE, Oregon State University, Corvallis, Oregon

Mr. Steve McConnell, Research Assistant-Silviculture, University of Idaho, Moscow, Idaho

Mr. Eric Horvath, Research Assistant, Department of Forest Science and Adaptive COPE, Oregon State University, Corvallis, Oregon

Mr. Doug Bateman, Research Assistant, Department of Forest Science and Adaptvie COPE Program, Oregon State University, Newport, Oregon

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

4. *Study Objective(s)*:

a. Determine whether suppressed and intermediate conifers released by manipulating overtopping vegetation respond with enhanced diameter and height growth.

b. Determine the characteristics of understory conifers that are best correlated with their response to release.

c. Determine the manipulations of overtopping vegetation that are best correlated with understory conifers response to release.

d. Provide land managers with easily measurable features (both seedling and stand characteristics) from which the success of release operations may be predicted.

5. *Potential Benefit or Utility of the Study*:

Establishment and growth of coniferous trees in riparian zones has been identified as a high priority for riparian zone management in the Oregon Coast Range. From a fish and wildlife perspective, a principal riparian management objective is to ensure recruitment of conifers as large woody debris (LWD) and snags. From a forestry perspective, trees within riparian zones can provide a source of harvestable timber, a portion of which may be utilized under current Forest Practice Regulations.

Presently, many riparian areas in the Coast Range are dominated by red alder rather than conifers because of past natural and human disturbances. Red alder does not attain the desirable size, strength, and decay resistance features of conifers and therefore is less desirable for fish and wildlife habitat. Coniferous trees also grow larger and are usually of higher value than red alder and thus are more desirable for timber.

Substantial numbers of suppressed and intermediate conifers exist in the understory of many alder-dominated riparian zones. Many of these are tolerant species which may eventually gain dominance over the site. Some are intolerant species and will eventually die if not released. Tolerant species left to attain dominance on their own will likely do so very slowly. The stocking of successful tolerant trees that become dominant on their own may also be very sporadic. Growth rates of tolerant species are likely to increase if released, shortening the time to their attainment of a size sufficient to have value as LWD, a usable snag, or a harvestable tree.

Release of understory conifers has been documented in other studies on upland sites. In many cases released conifers responded positively to release with increased height and diameter growth. Response in these studies began immediately after release or following only a short lag time. In some cases existing understory trees responded extremely slowly to release, however. Removing these existing trees and planting seedlings may have reduced the time required for establishment of a coniferous stand. In other cases removal of too much of the overstory resulted in stress and eventual mortality of understory conifers. Little is known about overstory removal responses in riparian stands. This study, in combination with information obtained from the Adaptive COPE study, "Establishment and Growth of Conifers under Existing Riparian Vegetation," will provide managers with a variety of strategies for managing riparian vegetation to obtain the multiple benefits afforded by the presence of conifers.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Collected end of growing season data and compiled data summaries.

Douglas-fir has sustained the heaviest mortality following release, apparently in responce to increased light.

b. Tasks Yet to Be Completed in FY 92:

Measure responses of understory vegetation to treatment (June 1992).

Analyze data.

c. Planned for FY 93:

Collect end of growing season data.

Quantify canopy cover over study trees.

Analyze data.

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

FY 1994
Collect end of growing season data.

Quantify canopy cover over study trees.

Analyze data.

FY 1995
Collect end of growing season data.

Quantify canopy cover over study trees.

Analyze data.

FY 1996
Complete final data collection and analysis, and prepare a draft manuscript for publication.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

Prepare **COPE Report** article on second-year results.

Participate in field tours, seminars, and workshops, as appropriate.

c. Planned for FY 93:

Participate in seminars, field trips, and workshops, as appropriate.

8. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 96

May 1992

Adaptive COPE
Progress Report

1. *Title:*

Active Management of Riparian Zones for Multiple Resources. III. Influence of Woody Debris Piece Size on Function in Small Streams

2. *Principal Investigator(s) and Organization(s):*

Mr. Arne Skaugset, Hydrologist, Department of Forest Engineering and Adaptive COPE, Oregon State University, Hatfield Marine Science Center, Newport
Dr. Robert Bilby, Aquatic Ecologist, Weyerhaeuser Company, Western Forestry Research Center, Centralia, Washington
Dr. James R. Sedell, Research Ecologist, Pacific Northwest Research Station, Corvallis
Mr. Ron Rhew, Research Assistant, Department of Forest Engineering and Adaptive COPE, Oregon State University, Hatfield Marine Science Center, Newport
Mr. James Schroeder, Hydrology Research Assistant, Adaptive COPE, Oregon State University, Hatfield Marine Science Center, Newport.

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s):*

Determine the relationship of debris piece size and orientation to debris stability, pool configuration, sediment storage, and fish habitat quantity and quality in small streams.

5. *Potential Benefit or Utility of the Study:*

State and federal riparian zone management regulations require the retention of specified amounts of standing timber along important fish-bearing streams following harvest of adjacent areas. The primary goal of these regulations has been to ensure a continued source of woody debris for streams. While the importance of wood in streams is generally recognized, our knowledge of the way in which characteristics of the debris, such as size, species, or orientation, influence the function of this material in streams of varying sizes is incomplete. The relationship between size of debris and its stability during high flow events also has not been clearly established. A more complete understanding of these interactions would allow the matching of debris characteristics to the needs of a particular stream, thereby maintaining fish habitat in these systems while minimizing landowner costs.

The purpose of this study is to experimentally evaluate the relationship between debris piece size and function in small stream systems of the Oregon Coast Range. Laboratory studies by R. Beschta at Oregon State University have shown a positive relationship between piece size and the size of a pool produced by that piece. Field surveys in southwestern Washington by B. Bilby and J. Ward have generally validated this relationship in larger streams, but the relationship does not appear as clear for small streams.

Experimental placement of pieces of wood of varying sizes in stream channels will be used in this study to examine the relationship between piece size and function. Three treatments (wood diameters of 8, 16, and 24 inches) will be established in each of two study streams. Study sites will be located on small, anadromous fish-bearing streams (channel widths 10-15 feet, Oregon Class I). Piece length in all three treatments will be a minimum of two times the width of the channel. Eight pieces of wood per treatment will be placed in the channel, four oriented perpendicular to the direction of flow and four oriented at a 45° angle to the channel. These two orientations were the most commonly observed during the surveys of streams in southwestern Washington. Unmanipulated reaches located upstream and downstream from treatment reaches will serve as controls.

Changes in channel morphology, sediment accumulation, debris stability, and fish populations at the study sites will be monitored through time. Morphology of the channel at debris placement sites will be carefully mapped prior to installing the wood and then remapped annually. The length of the study will depend upon the occurrence of high flows, which are primarily responsible for shaping the channel and determining the stability of debris pieces. Mapping of fish habitat will also be done along the entire experimental stream reach using the method developed by Bisson and others. Fish population surveys will be conducted during the winter and summer, beginning prior to debris placement in summer 1989 and continuing through the study. The purpose of these surveys is to compare the influence of the three treatments on seasonal use of the areas by salmonid fishes.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

      First-year results were analyzed and second-year data collected. Second-year data has been reduced and processed. All fisheries data has been reduced and processed.

b. Tasks Yet to Be Completed in FY 92:

Reduce and analyze field data.

c. Planned for FY 93:

Continue to monitor channel changes and fish populations in summer. Reduce and analyze data to include individual piece size effects on fish populations.

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

FY 1994
Continue to monitor channel changes and fish populations. Use channel change data along with stream flow data to validate flume studies of local scour associated with woody debris. Generate an empirical model predicting local scour due to woody debris.

FY 1995
Continue to monitor channel changes and fish populations. Reduce and analyze data to investigate the effect of piece size on local scour, fish habitat, and fish populations.

FY 1996
Continue to monitor channel changes and fish populations. Modify local scour model and fish habitat population models as needed.

FY 1997
Continue to monitor channel changes and fish populations. Modify local scour model and fish habitat population models as needed.

FY 1998
Synthesize, reduce and analyze data. Generate a final scour model. Also, finalize model on the effect of piece size and orientation of habitat and populations.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

December 11, 1991. "The Effect of Large Woody Debris Piece Size and Orientation on Aquatic Habitat: First Year Results. Presented to the Northwest Forestry Association by A. Skaugset. Forestry Sciences Laboratory, Corvallis, Oregon.

b. Planned for Remainder of FY 92:

None.

c. Planned for FY 93:

Prepare a manuscript on second-year results.

Participate in seminars, field trips, and workshops as appropriate.

8. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 98

May 1992

Adaptive COPE
Progress Report

1. *Title:*

Stability Assessment of End-Haul Disposal Areas

2. *Principal Investigator(s) and Organization(s):*

Mr. Arne E. Skaugset, Hydrologist/Geotechnical Specialist, Department of Forest Engineering and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport
Dr. Marvin R. Pyles, Associate Professor, Department of Forest Engineering Oregon State University, Corvallis
Mr. James Schroeder, Research Assistant, Department of Forest Engineering and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport
Mr. Dave Michael, Geotechnical Specialist, Oregon Department of Forestry, Forest Grove
Mr. Keith Mills, Geotechnical Specialist, Oregon Department of Forestry, Salem
Mr. John Seward, Geotechnical Specialist, Oregon Department of Forestry, Roseburg

3. *Management Issue and Research Task (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.

4. *Study Objective(s):*

a. Develop a procedure to determine the location and then rank the stability of potential end-haul disposal areas on a basin scale.

b. Develop a procedure to assess the relative and/or absolute stability of end-haul disposal areas on a site specific scale.

c. Validate the above set of procedures by implementing them in field case studies on basin and site specific scales.

5. *Potential Benefit or Utility of the Study*:

Research results indicate that timber harvesting activities can increase the frequency of landslides on steep, landslide prone slopes of the Pacific Northwest. Some investigators have shown that roads are an important factor associated with the increased incidence of landslides on forest lands. Over the years, management practices have been developed which minimize road related failures. These practices include reducing the amount of land in roads, avoiding road locations in high risk sites, and improving site specific construction and maintenance practices.

One practice used to minimize road related landslides is waste disposal by end-hauling. End-hauling is the practice of moving spoil material, generated from road construction, from unstable sites to more stable locations. This practice is used whenever roads are constructed on slopes greater than 50 to 70 percent. Often, logging engineers will consider many alternatives, including different logging systems and road locations, before electing to end-haul a section of road.

At times however, logging roads must be built through high risk terrain and end-hauling is required. A significant problem in these cases is locating sites for disposal of the spoil material. Relatively flat, stable sites which are most suitable for end-haul disposal are not abundant in steep, landslide prone terrain. This problem has never been investigated rigorously, so there are no formal criteria for choosing end-haul disposal areas. The purpose of this project is to develop a set of procedures for siting end-haul disposal areas on a basin scale and for evaluating the relative and/or absolute stability of these selected areas on a site specific scale.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

None.

b. Tasks Yet to Be Completed in FY 92:

None. Work on this study will be delayed until FY93 because of personnel limitations.

c. Planned for FY 93:

Prepare a detailed study plan.

Conduct field survey work (geologic overlay).

d. Tasks to Be Completed By Fiscal Year Starting in FY 94:

Analyze data and prepare a final study report.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None.

b. Planned for Remainder of FY 92:

None.

c. Planned for FY 93:

Prepare a **COPE Report** article.

Participate in seminars, workshops, and field trips as appropriate.

8. *Duration of the Study*:

Initiation Date:	FY 90
Scheduled Completion Date:	FY 94

May 1992

Adaptive COPE
Progress Report

1. *Title*:

Interdisciplinary Research and Demonstration Area Project (IRDAP)

2. *Principal Investigators and Organizations*:

Dr. Gabriel Tucker, Assistant Professor, Department of Forest Science and Adaptive COPE Team, Oregon State University, Hatfield Marine Science Center, Newport

Mr. Arne Skaugset, Instructor, Department of Forest Engineering and Adaptive COPE Team, Hatfield Marine Science Center, Newport

Mr. Ron Rhew, Research Assistant, Department of Forest Engineering and Adaptive COPE Team, Hatfield Marine Science Center, Newport

Ms. Barbara Schrader, Research Assistant, Department of Forest Science and Adaptive COPE Team, Oregon State University, Hatfield Marine Science Center, Newport

Mr. Douglas Bateman, Research Assistant, Department of Forest Engineering and Adaptive COPE Team, Hatfield Marine Science Center, Newport

Mr. Eric Horvath, Research Assistant, Department of Forest Science and Adaptive COPE Team, Oregon State University, Hatfield Marine Science Center, Newport

Pei-fen Lee, Research Assistant, Department of Forest Science and Adaptive COPE Team, Oregon State University, Hatfield Marine Science Center, Newport

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

b. Identify and integrate associations among ecosystem components in riparian areas and explain their ecological relationships.

4. *Study Objective(s)*:

a. Quantify the responses of selected forest resources to alternative silvicultural prescriptions in second-growth stands in the Oregon Coast Range.

b. Determine processes or mechanisms that underlie key responses.

c. Quantify and evaluate operational constraints of implementing the harvest treatments relative to feasibility and economics.

d. Provide sites that demonstrate the implementation of alternative silvicultural prescriptions for uplands and riparian zones in headwater basins.

e. Synthesize the results to identify the ecological and operational consequences for multiple resources of the alternative prescriptions.

Stand-Scale Silvicultural Prescriptions:

a. Objective - Maximize wood production.

Target Stand Structure - Even tree size and age

Prescription - clearcut, no structural retention, intensive site preparation, single species planting, pre-commercial thinning, short rotation

b. Objective - Optimize wood production and plant and animal diversity

Target Stand Structure - Two to four tree size and age classes; moderate levels of shrubs, snags, fallen trees; overstory retention dispersed

Prescription - clearcut, 15% retention of live trees, snags, fallen logs, shrubs; retention dispersed, moderate site preparation, multiple species planting, variable thinning, moderate rotation

c. Objective - Maximize water quality and late-seral plant and animal diversity

Target Stand Structure - Multiple tree ages and sizes, multiple canopy layers, high levels of spatial heterogeneity in canopy, high levels of snags, fallen trees, shrubs

Prescription - group selection, variable sizes; site preparation if feasible, planting of multiple species, variable thinning, creation of snags and fallen logs, long rotation

Response Variables:

Commercial trees - volume harvested, natural and planted seedling survival and growth rates, overstory survival (including blow-down rates) and growth rates.

Vegetation - structure, composition, diversity, shrub survival, growth, seed production

Soil - compaction, nutrient status, structure, slide potential

Microclimate - solar radiation, humidity, air and soil temperature, wind speed

Wildlife - community structure and composition

5. *Potential Benefit or Utility of the Study*:

Public demand for increasing levels of diverse natural resources is fueling rapid change in forestry. Land managers are being challenged to maintain suitable levels of wood production while also providing for biological diversity, water quality, long-term site productivity, and human recreation and aesthetic values. A variety of new silvicultural practices are presently under development in the Northwest to address this challenge. There is a need to evaluate the ecological and operational consequences of such alternative treatments.

Among the key issues are the responses of wood production and species diversity to forest management practices. Evidence is mounting that traditional forest practices in the Coastal Northwest can negatively impact native species diversity. By removing live trees, snags, and fallen trees in uplands, these practices simplify the microhabitat heterogeneity typical of natural forests and sometimes lower the abundance or diversity of floral and faunal communities.

Innovative new silvicultural approaches are now being designed and, in some cases, implemented in an attempt to better optimize wood production, conserve biodiversity and water quality. Varying levels of live trees, snags, fallen trees, and shrubs are now commonly retained on federal forest lands in the region. Such designs are specified in many of the new National Forest Plans and these structurally-rich harvest units are likely to become even more common.

There is much concern, however, over how these new approaches may effect wood production, harvest costs, reforestation success, and human safety. Critics argue that the retention of some canopy trees will shade the regenerating plantation and reduce tree growth, a position supported by some simulation modelling efforts. Moreover, the presence of native shrubs is likely to increase competition with commercial seedlings. harvest costs are apt to be higher in these units than in traditional clearcuts and the presence of live trees, snags, and downed logs may make site preparation more difficult and more hazardous for field workers.

At the same time, it is not clear how effective these efforts may be in conserving biodiversity. The possible benefits of structural retention for species diversity are little known. Several studies have shown that the retention of snags in harvest units does provide breeding habitat for several cavity-nesting birds. But much less is known about wildlife response to retention of green trees, shrubs, and downed logs. A pilot study in the west Cascades of Oregon found that several species of forest-dwelling birds that avoided clearcuts were present in shelterwood sites. Their densities in shelterwoods were so low, however, to raise question as to the value of this habitat for these species. Retention of canopy trees in plantations also arouses concern that shading will be sufficient to reduce habitat quality for the large number of plant and animal species that specialize on open-canopy stands. Some of these species are declining in abundance over the region and merit interest from conservationists.

Forest managers are clearly in need of information that will allow them to predict the trade-offs in wood production, operational constraints, habitat diversity, and water quality of differing levels and configurations of structural retention.

The proposed study is designed to provide land managers with such information. The experimental design will be rigorous in having well-defined treatments, replication, and pre- and post treatment measurements. Several response variables will be monitored including commercial tree growth rates, and structure and diversity of plant, wildlife, aquatic insect and fish communities. Also, the operational constraints associated with the treatments will be documented. This approach will allow the operational and ecological trade-offs of these silvicultural treatments to be quantified. This study is being designed to not only yield useful information during the COPE Program but long after the program has been completed in 1998. These installations could potentially be utilized by other research programs to evaluate the long-term effects of the treatments imposed during COPE.

Another benefit of the study involves monitoring protocols. National Forest Plans call for increasing monitoring efforts but the rigorous scientific methodologies have in many cases not yet been developed. Some of the sampling protocols we develop may well be exportable for other applications.

Finally, this project will provide demonstration sites where resource managers, policy makers, and scientists can view alternative harvest units and discuss the associated resource and operational trade-offs.

6. *Research Activities:*

It is propsed that this study be discontinued and be replaced by the following new studies, prospecti for which are contained in this progress report:

a. The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands.

b. Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coast Range.

These studies embody many of the characteristics of IRDAP but on a reduced scale. This would overcome the difficult problem of identifying suitable study areas for IRDAP which has proven a severe obstacle because of the large acreages needed with very specific site characteristics. The northern spotted owl regulations have made this particularly difficult. Secondly, the proposed studies can be completed with the funding resource likely to be available for the duration of Adaptive COPE. Moreover, both studies can be initiated during the current fiscal year and cooperators have already identified sites suitable for study installations.

7. *Publication and Technology Transfer Activities*:

None.

8. *Duration of Study*:

Initiation Date: FY 92
Scheduled Completion Date:
Recommended for termination in FY 92

9. *Estimated Cost*:

	OSU
FY 92	250,000
FY 93	262,000
FY 94	275,000
FY 95	289,000
FY 96	303,000
FY 97	318,000
FY 98	334,000

May 1992

Adaptive COPE
Progress Report

1. *Title:*

A Synthesis of Reforestation Practices with Constraints on Fire and Herbicides

2. *Principal Investigator(s) and Organization(s):*

Dr. Gabe Tucker, Silviculture Scientist, Assistant Professor, Department of Forest Science, OSU and Adaptive COPE Team, Hatfield Marine Science Center, Newport

Dr. William Emmingham, Associate Professor, Department of Forest Science, OSU, Corvallis

Dr. Stephen D. Hobbs, Associate Professor, Department of Forest Science, OSU, Corvallis

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

a. Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

b. Examine the economics of the above-mentioned strategies and assess the economic impacts of constraints on fire and herbicides.

4. *Study Objective(s):*

a. Synthesize current information on vegetation management and reforestation strategies and treatments, where use of fire and herbicides are constrained, that are applicable to the Oregon Coast Range.

b. From this synthesis, develop a study prospectus to test a specific hypothesis on the use of alternative vegetation management or reforestation techniques.

5. *Potential Benefit or Utility of the Study:*

Land managers reap a variety of benefits from prescribed burning and herbicides in their reforestation efforts. Herbicides control unwanted vegetation that compete with planted seedlings for moisture and light, or provide habitat for animal pests that damage seedlings. Prescribed burning also provides temporary and effective control of competing vegetation that can help seedlings get established. In addition, prescribed burning also controls habitat of animal pests that may kill or damage planted seedlings, allows for planter access to harvested sites, and reduces the potential for a damaging wildfire on a site in the future.

Use of these tools has been constrained recently by legal and social considerations. The extent to which they are constrained varies between organizations and by location. Constraints on prescribed burning has affected land management organizations more or less ubiquitously. "Burn days" are harder to come by, limited by pressure to limit smoke encroachment into areas of human population or other restricted areas. Competition from other managers wishing to burn on the limited days with meteorologic conditions under which burning may take place results in few managers able to burn as much as they like. herbicide use was curtailed in federal organizations in 1983 by court order and will likely be used only with substantial restrictions even after processes are complete that reestablish it as a tool on federal lands. Other organizations occasionally limit herbicide use for reasons including social ones at their own discretion.

As a result of limitations on prescribed burning and herbicides many managers have experimented with alternative vegetation management treatments. Many innovations have been made, modified, and improved. Information on the various approaches has not been documented, however, nor has their effectiveness and cost efficiency been compared and shared among user groups. A synthesis document of management alternatives used where prescribed burning or herbicides are constrained will disseminate findings of managers and researchers throughout the Coast Range and allow for cursory comparison of cost/efficiency of some of the techniques used.

6. *Research Activities*:

   a. Accomplishments to Date in FY 92:

   A working-draft manuscript was completed and circulated to silviculturists. A meeting was then held in Corvallis on May 5 with silviculturists to discuss their review comments and ideas for the final manuscript.

   b. Tasks Yet to Be Completed in FY 92:

   Prepare the final draft manuscript.

7. *Publication and Technology Transfer Activities*:

   a. Completed to Date in FY 92:

   Worked with silviculturists to refine the existing working draft manuscript.

b. Planned for Remainder of FY 92:

Prepare final document.

8. *Duration of the Study*:

Initiation date:	FY 89
Scheduled Completion date:	FY 92

use, since burning also controls [illegible] [illegible] seedlings, allows for planting access to harvested sites, and reduces the potential for a damaging wildfire once site is [illegible].

Use of this practice has been constrained recently by [illegible] factors. The extent to which they are constrained varies between organizations and by location. Constraints on prescribed burning use are [illegible] more or less stringently. [illegible] to limit smoke encroachment into areas of human population or other sensitive areas. Competition from other managers wanting to burn on available days with meteorologic conditions under which burning may take place results in few managers able to burn as much as they like. [illegible] in federal organizations in 1983 by court order and was limited for use only with substantial restrictions even after proposals are completed that recommend it as a tool on federal lands. Other organizations occasionally avoid herbicide use for reasons including social ones at their own discretion.

As a result of restrictions on prescribed burning and herbicides many managers have experimented with alternative vegetation management treatments. Many innovations have been made, modified, and improved. Information on the various approaches has not been documented, however, nor has their effectiveness and cost efficiency been compared and shared among user groups. A synthesis document of management alternatives used where prescribed burning or herbicides are constrained will disseminate findings of managers and researchers throughout the Coast Range and allow for cursory comparison of cost/efficiency of some of the techniques used.

e. *Research Activities*

a. Accomplishments to Date in FY 92

A working draft manuscript was completed and circulated to [illegible]. A meeting was then held in Corvallis on May 5 with [illegible] to discuss their review comments and plans for the final manuscript.

b. Tasks Yet to Be Completed in FY 92

Prepare the final draft manuscript.

f. *Publication and Technology Transfer Activities*

a. Completed to Date in FY 92

Worked with [illegible] the existing working draft manuscript.

May 1992

Adaptive COPE
Progress Report

1. *Title:*

Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes

2. *Principal Investigator(s) and Organization(s):*

Dr. Andrew J. Hansen, Assistant Professor, Adaptive COPE Team, OSU Hatfield Marine Science Center, Newport

3. *Management Issues and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

a. Identify relationships between wildlife populations, habitat, and damage to young conifer plantations.

b. Develop conceptual models of habitat manipulation in order to learn how to minimize animal damage to young conifer plantations.

Riparian Zone Management

a. Identify wildlife species in and adjacent to riparian habitats.

b. Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

4. *Study Objective(s):*

a. Determine patterns of wildlife abundance and associations with vegetation in three prevalent forest stand types: managed, open-canopy plantations (2-8 yrs old); managed closed-canopy plantations (25-30 yrs old); and mature natural stands.

b. Quantify wildlife community characteristics and habitats along a gradient from stand edges to stand interiors.

c. Determine the distribution of stand types, stand sizes, edge types, and edge lengths across the study area using aerial photograph interpretation.

5. *Potential Benefit or Utility of the Study:*

Currently little is known about wildlife habitat associations in the managed forests of the Oregon Coast Range. Yet such information is essential for the integrated management of wildlife and timber on multiple-use forest lands. Particularly pressing is the need for information on: wildlife community characteristics in intensively managed plantations; comparisons with wildlife patterns in surrounding natural forests; and wildlife responses to stand edges. This information will be useful for management decisions that best accomplish wildlife and wood production objectives on forest lands. Data from this study will also complement that developed for riparian wildlife communities.

6. *Research Activities:*

a. Accomplishments to Date in FY 92:

We have continued to analyze the field data on wildlife community response to stand and edge types in managed forests. We have found that some species are strongly associated with specific microhabitat configuration while others respond strongly to forest/clearcut edges.

b. Tasks Yet to Be Completed in FY 92:

Finalize data interpretation and prepare scientific articles.

7. *Publication and Technology Transfer Activities:*

a. Completed to Date in FY 92:

A.J. Hansen, S. Garman, B. Marks and P. Lee. In Prep. An approach for managing vertebrate diversity at the landscape scale. 65 pgs. for Ecological Applications.

D.L. Urban, A.J. Hansen. D.O. Wallin and P. H. Halpin. In Review. Life-history attributes and biodiversity: Scaling implications for global change. O. Solbrig, editor. Biodiversity and Global Change. Kluiwer Academic Publishers, Dordrecht, The Netherlands.

A.J. Hansen and D.L. Urban. In Press. Avaian response to landscape pattern: The role of species life histories. Landscape Ecology.

10/24/91. A system for managing vertebrate diversity at the landscape scale. Guest Lecture. Malheur National Forest, John Day, Oregon.

01/16/92. An introduction to biodiversity. Forestry students lecture series on Managing Biodiversity. College of Forestry, Oregon State University, Corvallis, Oregon.

b. Planned for Remainder of FY 92:

Complete several scientific papers.

Prepare **COPE Report** article.

Participate in seminars, workshops, and field trips, as appropriate.

8. *Duration of the Study:*

Initiation date:	FY 89
Scheduled Completion date:	FY 92

May 1992

Adaptive COPE
Progress Report

1. *Title:*

Adaptation of a Forest Succession and Wildlife Habitat Model to Managed Coast Range Forests

2. *Principal Investigator(s) and Organization(s):*

Dr. Andrew J. Hansen, Assistant Professor, Department of Forest Science and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport

Mr. Steve Garman, Research Assistant, Department of Forest Science and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport

Cooperators:

Dr. Dean Urban, Research Associate, Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia

Dr. Barry Noon, Project Leader, Pacific Southwest Research Station, Arcata, California

Dr. William McComb, Associate Professor, Department of Forest Science, Oregon State University, Corvallis

Dr. Martin Raphael, Research Ecologist, Pacific Northwest Research Station, Olympia, Washington.

3. *Management Issues and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

a. Identify relationships between wildlife populations, habitat, and damage to young conifer plantations.

b. Develop conceptual models of habitat manipulation in order to learn how to minimize animal damage to young conifer plantations.

Riparian Zone Management

Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

4. *Study Objective(s):*

   a. Adapt FORET/ZELIG, a widely used stand simulation model, to Oregon Coast Range conditions.

   b. Develop a wildlife habitat subroutine that classifies model output in terms of suitability as wildlife habitat.

   c. Validate the model by comparing simulation results to actual field data for tree and shrub performance and wildlife habitat characteristics in managed plantations and natural stands in the Drift Creek Basin.

   d. Use the model to predict: wildlife habitat characteristics of plantations under various silvicultural treatments and long-term Douglas-fir growth rates under various levels of animal damage.

5. *Potential Benefit or Utility of the Study:*

Forest development and wildlife communities are strongly interrelated; wildlife pests reduce wood production while silvicultural treatments influence wildlife habitats. These interrelationships are difficult to study because of the long period of time required for stand development. Few studies in the Pacific Northwest, for example, have examined the response of tree seedlings to animal herbivory for more than a few years. Similarly, the dynamics of wildlife habitats in managed forests over the full rotation cycle are poorly known. Simulation models can help. They are widely used to examine long-term forest responses to management practices and natural disturbances.

Several types of simulation have been developed for different applications. Shrubs and understory are important components of wildlife habitat and a model that deals with mixed-species, mixed-age stands is required for our purposes. The model also needs to output vegetation data in the form of habitat measurements in wildlife studies. Finally, the model should be able to simulate tree and shrub growth under various management and disturbance regimes.

The FORET family of models has these capabilities. They simulate the establishment, growth, and death of individual trees probabilistically based on species life histories, competition from neighboring plants, and local disturbance regimes. These models have been used to simulate forest and habitat response to: various thinning regimes, insect and mammal herbivory, and air pollution. Over 20 versions have been developed around the world, including one for the Pacific Northwest (ZELIG).

We will adapt ZELIG, a version of FORET, for use in plantations and natural stands in the Oregon Coast Range. Additionally, we will expand consideration of shrubs, snags and downed logs in the model and add a subroutine for classifying wildlife habitats. The model will be used to predict tree response to browsing and the long-term dynamics of wildlife habitat in managed forests. The model, once in place, will be useful for broader application to problems of riparian zone silviculture, snag and woody debris dynamics, and landscape-level forest management. The model will be developed in coordination with other Fundamental and Adaptive COPE studies.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Completed extensive progress report on model validation and application.

b. Tasks Yet to Be Completed in FY 92:

Test model performance.

Apply the model to questions of impacts of alternative silvicultural prescriptions.

c. Planned for FY 93:

Publication of final products.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

12/14/91. Understanding and managing ecotones. SCOPE workshop on Landscape Management. Moscow, USSR.

12/16/91. Managing biodiversity. Stream Team Monday Seminar Series. Fish and Willife Department, OSU, Corvallis.

Hansen, A. J., D. L. Urban and B. Marks. 1992. Avian community dynamics: The interplay of landscape trajectories and species life histories. Pages 170-195 In A. J. Hansen and F. Di Castri, editors. Landscape Boundaries: Consequences for biotic diversity and ecological flows. Springer Verlag Ecological Studies Series, New York.

Hansen, A. and S. Gorman. 1992. An approach for managing vertebrate diversity across multiple use landscapes. COPE REPORT (in Press).

Garman, C.L., A.J. Hansen, P. Lee. 1991. Response of Plant and Animal Habitat Diversity to Forest Management and Climate Change: A Modeling Approach. Progress Report, Department of Forest Science, OSU, Corvallis, Oregon.

b. Planned for Remainder of FY 92:

Scientific publications will be prepared.

Prepare an article for the **COPE Report**.

Participate in field tours, seminars, and workshops as appropriate.

c. Planned for FY 93:

None.

8. *Duration of the Study*:

Initiation Date: FY 90
Scheduled Completion Date: FY 93

May 1992

Adaptive COPE
Progress Report

1. *Title*:

Effects of Forage Seeding on Establishment and Growth of Douglas-fir Seedlings

2. *Principal Investigator(s) and Organization(s)*:

Dr. Tim Harrington, Research Associate, Department of Forest Science, College of Forestry, Oregon State University, Corvallis

Dr. Gabe Tucker, Assistant Professor, Department of Forest Science and Adaptive COPE Program, Oregon State University, Hatfield Marine Science Center, Newport

Mr. Steve McConnell, Research Assistant, University of Idaho, Moscow

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Reforestation in the Oregon Coast Range

a. Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.

b. Examine the economics of the above-mentioned strategies and assess the economic impacts of constraints on fire and herbicides.

4. *Study Objective(s)*:

a. Quantify the effect of a range of grass-legume forage seeding mixes on the survival and growth of Douglas-fir seedlings.

b. Determine the relative competitive ability of natural vs. forage-seeded herbaceous communities.

c. Determine the extent to which forage seeding reduces the invasion and growth of the natural woody and herbaceous competitors of Douglas-fir.

d. Determine the growth response of Douglas-fir to herbaceous weed control treatments applied at different plantation ages.

5. *Potential Benefit or Utility of the Study*:

Forage seeding of recently burned clearcuts with a grass-legume mix is being encouraged as a method of multiple resource management. Forage seeding provides a nutrient-rich food source for big game wildlife (e.g., elk and deer), purportedly reduces establishment of native brush and herbs which compete with planted conifer seedlings, and protects against soil erosion.

The nutritive effects to wildlife and prevention of soil erosion have been documented in other studies. There is little information on the effect of introduced grass-legume mixtures on survival and growth of planted conifer seedlings or the extent of brush control attained from forage seeding, however. Recent studies indicate that herbaceous vegetation may reduce growth of Douglas-fir seedlings even on the moist sites characteristic of the Oregon Coast Range. Quantitative information on the extent of vegetation control attained from forage seedling and the effect this method of brush control has on growth and survival of seedlings is lacking.

Tradeoffs in terms of potential multi-resource benefits cannot be conclusively determined until effects to seedlings, either by increasing competition from the forage mix, or reducing competition by preventing establishment of native vegetation, are determined. Therefore, this study will quantify growth and survival of planted Douglas-fir seedlings in response to various combinations of grass-legume mixtures, and monitor the invasion of natural woody and herbaceous competitors in seeded and unseeded plots and quantify the survival and growth of Douglas-fir seedlings in relation to the competition conditions that result.

Additionally, as some managers are including herbaceous weed control in their normal plantation establishment treatments, this study will explore conifer growth response to different regimes of timing of herbaceous weed control in the first five years after planting.

6. *Research Activities*:

a. Accomplishments to Date in FY 92:

Adaptive COPE participation in this study has been terminated in order to focus on other research studies. This work will be continued, however, by Oregon State University's CRAFTS Program.

b. Tasks Yet to Be Completed in FY 92:

Collect initial seedling measurements (Spring).

Collect 1st year measurements (Spring).

c. Planned for FY 93:

None. Adaptive COPE participation in this study terminated.

7. *Publication and Technology Transfer Activities*:

a. Completed to Date in FY 92:

None. Adaptive COPE participation in this study terminated.

b. Planned for Remainder of FY 92:

None

c. Planned for FY 93:

None

8. *Duration of the Study*:

Initiation Date: FY 90
Scheduled Completion Date: Study terminated in FY 92.

May 1992

Adaptive COPE
Progress Report

1. *Title*:

Technology Transfer Activities

2. *Principal Investigator(s) and Organization(s):*

Adaptive COPE Team, College of Forestry, OSU, Newport.

3. *Technology Transfer Accomplishments to Date in FY 92*:

a. Workshops:

Conducted a workshop on stream survey design and methodology. October 16-17, 1991. Newport, OR.

Conducted a workshop on the design and maintenance of forest road drainage. November 18-20, 1992. Corvallis, OR.

Conducted a workshop on construction and maintenance of forest roads for small woodland owners. May 30, 1992. Newport, OR.

b. Other Activities:

Published two issues of the **COPE Report**.

COPE poster was displayed at the Oregon Society of American Foresters Annual Meeting. April 12-14, 1992. Salishan Lodge, Gleneden Beach, OR.

Presentation on Adaptive COPE research and technology transfer activities at a briefing of the timber industry, April 3, 1992, Corvallis, OR.

Presentation on effects of large woody debris on aquatic habitat to Northwest Forestry Association. December 11, 1991. Corvallis, OR.

Co-sponsored the "Big Picture" field tour at the annual meeting of the Oregon Society of American Foresters. April 15, 1992. Lincoln City, OR.

Presentation of riparian silviculture and stream enhancement research results to Board of Forestry field tour on water classification and protection. April 16, 1992. Salem, OR.

COPE Riparian Project poster was presented at: "California Riparian Systems: Progress in Protection and Restoration." November 14-15, 1991. University of California, Davis. Sacramento, CA.

Participated in the workshop "Monitoring Responses to Forest Management". March 10-11, 1992. Oregon State University, Corvallis, OR.

Presentation on interdisciplinary resource management for the Oregon Coast Range: Can we C.O.P.E. with the challenge? Mark O. Hatfield Marine Science Center Seminar Series. July 24, 1991. Newport, OR.

Tucker, G.F., A.E. Skaugset, R. Rhew, and A.J. Hansen. 1991. C.O.P.E. Coastal Oregon Productivity Enhancement. Poster presentation with abstract published in Proceedings of the Society of American Foresters National Convention, San Francisco, CA., August 4-7.

Tucker, G.F., W.H. Emmingham, B.A. Schrader. 1991. Underplanting riparian areas in the Oregon Coast Range: Growing trees for fish. 82nd Annual Western Forestry and Conservation Association Conference, Victoria, British Columbia, December 3-6.

Presentation on upland forest ecology. Training for Hatfield Marine Science and Oregon Coast Aquarium volunteers. Two lectures given in spring 1992 session.

Presentation on interdisciplinary resource management. Evergreen State College, Agroecology Course, Olympia, Washington, April 30, 1992.

Tucker, G.F. and J.R. Powell. 1991. An improved canopy access technique. Journal of Forestry 89(11)31-35.

Tucker, G.F. and J.R. Powell. 1992. An improved canopy access technique. Arboricultural Journal 16(4) (in press).

Tucker, G., A. Skaugset, A. Hansen, R. Rhew, J. Schroeder, S. McConnell. 1991. Adaptive COPE annual report, October 1, 1990 - September 30, 1991, Oregon State University, College of Forestry, Forestry Research Laboratory, 30 pp., ills.

4. *Planned for Remainder of FY 92:*

a. *Workshops:*

Conduct a workshops on red alder management for small woodland owners. (Scheduled for July 18, 1992 in Astoria, Oregon).

Conduct a regional symposium on the assessment of stream habitat inventory and monitoring programs (Postponed until early FY 93).

b. *Other Activities*:

Prepare a manuscript on impacts of alternative silviculture on wildlife habitat.

Prepare a manuscript on survey of land managers on forest road drainage.

Publish two issues of the **COPE Report**.

Prepare an annual report.

Increase public awareness of the COPE Program through the media and presentations to civic groups.

Continue to work closely with resource manager through office visits and field trips.

5. *Technology Transfer Plans for FY 93*:

a. *Workshops*:

Conduct a regional symposium on the assessment of stream habitat inventory and monitoring programs (originally scheduled for FY-92).

Conduct a symposium on slope stability, soil compaction, organic debris in streams, and riparian zone managment. (Scheduled for November 17, 1992 in Corvallis, OR.)

Conduct a field workshop on commercial thinning to enhance wildlife habitat.

b. *Other Activities*:

Prepare a poster on second-year results of the riparian silviculture underplanting study.

Prepare video-tapes, slide-tapes, and leaflets on broadleaf shrub ecology in conjunction with the Forestry Media Center at Oregon State University.

Prepare four issues of the quarterly newsletter **COPE Report**.

Prepare an annual report.

Increase public awareness of the COPE Program through the media and presentations to civic groups.

Work closely with resource managers through office visits and field tours.

PROPOSED FUNDAMENTAL and ADAPTIVE STUDIES FOR FY 93

LIST OF PROPOSED FUNDAMENTAL COPE STUDIES PROSPECTI FOR FY 1993

Page

I. *Riparian Zone Management*

A. Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range (Loren D. Kellogg, OSU) 147

B. Economic Analysis of Forest Management--Fisheries Interactions (Susan J. Alexander, PNW) 150

C. Management Policies for Increasing Recreation's Contribution to the Economies of Oregon Coast Range Communities (Rebecca L. Johnson, and Kreg Lindberg, OSU) 152

II. *Reforestation in the Oregon Coast Range*

A. None.

LIST OF PROPOSED ADAPTIVE COPE STUDIES PROSPECTI FOR FY 1993

III. *Riparian Zone Management*

A. Long-term Response of Resident Cutthroat Trout to Forest Harvest in Headwater Drainages of Oregon's Coast Range (Arne Skaugset, James D. Hall and Patrick J. Connally, OSU) 155

B. Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coast Range (Arne Skaugset, John Hayes and Gabriel Tucker, OSU) 158

IV. *Reforestation in the Oregon Coast Range*

A. The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands (Gabriel F. Tucker, William H. Emmingham, John P. Hayes, Arne Skaugset, Barbara Schrader, OSU; Stuart Johnston, Siuslaw National Forest; Sam Chan and Don Minore, PNW) 162

May 1992

Fundamental COPE
Study Prospectus

1. *Title*:

Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range

2. *Principal Investigators and Organizations*:

Dr. Loren D. Kellogg, Associate Professor, Department of Forest Engineering, Oregon State University, Corvallis

This study will be conducted in cooperation with and in support of the Adaptive COPE study: Integrated Responses of Multiple Forest Resources to Active Management in Riparian Zones in the Oregon Coast Range. This study will be initiated during the current fiscal year. It is intended to replace the Fundamental COPE study: Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions which started in FY 92.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

Test and compare harvesting systems that enable managers to achieve various states of fish and wildlife habitat and levels of timber production in riparian areas.

4. *Study Objective(s)*:

   a. Identify a planning process for harvest treatments which allows several levels of timber retention and includes management objectives for biological diversity, conifer establishment in close proximity to streams, and placement of large woody debris in streams, while assuring efficient future forest establishment and harvesting.

   b. Identify and evaluate operational constraints of implementing harvest treatments relative to logging feasibility and human safety.

   c. Quantify logging production and cost associated with harvest treatments.

   d. Quantify timber value recovered as well as that retained for biological diversity and riparian area management.

e. Provide logging information (feasibility, methods, costs) associated with tree removal close to streams and placement of large woody debris in streams at the time of harvest. Identify efficiencies achievable by combining stream enhancement and riparian area management with operational timber harvesting.

5. *Justification:*

It is important that forest operations are adequately considered when evaluating response of multiple forest resources to alternative silviculture prescriptions. There are many logging constraints associated with steep terrain and cable operations in the Oregon Coast Range. Nontraditional silvicultural prescriptions must be evaluated for feasibility and cost. In addition, worker safety is an area of concern by the timber industry. For a complete identification and evaluation of these prescriptions, information needs to be obtained and presented concerning operational logging issues as well as other multiple forest resource issues.

To date the limited number of alternative silvicultural systems that are being studied have focused on low levels of timber removal and scattering retention areas uniformly over the site. There have not been any studies aimed at evaluating the other end of the spectrum: silvicultural systems that maximize current timber yield and future wood production while providing for a reasonable amount of biological diversity. This goal may be more appropriate for private industry and needs to be evaluated.

6. *Anticipated Initiation and Completion Dates:*

June 2, 1992 to Sepember 30, 1995

7. *Proposed Tasks to be Completed by Fiscal Year:*

FY 1992

Prepare a study plan. Work with Adaptive COPE team and cooperators in selecting study sites and making arrangements for the implementation of harvest treatments (logging planning and layout). Work on study objective a.

FY 1993

Continue with site selection and harvesting arrangements. Installation of treatments; continue with study objective a. Harvesting data collection for study objective b, c, d, and e.

FY 1994

Installation of treatments. Harvesting data collection for study objective b, c, d, and e.

FY 1995

Data analysis and reporting of results.

8. *Publication and Technology Transfer Activities*:

Presented study results at COPE workshops and other appropriate meetings, contribute to the **COPE Report** and site tours organized by Adaptive COPE leaders, publish study results as they become available in refereed journal articles and other publications.

9. *Estimated Cost*:

	OSU
FY 92	64,000
FY 93	67,000
FY 94	70,000
FY 95	73,000

May 1992

Fundamental COPE
Study Prospectus

1. *Title:*

Economic Analysis of Forest Management--Fisheries Interactions

2. *Principal Investigators and Organizations:*

Susan J. Alexander, Research Forester, Pacific Northwest Research Station, Corvallis, Oregon

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Riparian Zone Management

Develop economic models capable of assessing the economic impacts of various management regimes in riparian zones, and apply them to conditions prevailing on the Oregon Coast.

4. *Study Objective(s):*

Assess the economic impacts of forestry on fisheries, by attempting to establish through model integration how forest management affects fish production, or by comparing implied prices of fisheries (using shadow prices in forest plans) with recreational and commercial prices for fish, or both.

5. *Justification:*

The interaction of forest management and fisheries is a topic being debated as forest planners have come to realize that management activities have many, diverse and significant effects on non-timber resources. Translating management activities into economic gains or losses for salmon and steelhead fishing has been attempted many times. The attempts are often inadequte on two grounds: first, the lack of models relating forest practices to fish habitat means that the all-or-nothing studies contain no incremental analysis, and second, economic analyses fail to provide values consistent with consumer theory. A study that addresses the poorly understood economic effects of forest management on fisheries will help the debate underway in the Pacific Northwest to attain a conclusion based on sound scientific principles.

6. *Anticipated Initiation and Completion Dates*:

October 1, 1992 to September 30, 1995.

7. *Proposed Tasks to be Completed by Fiscal Year*:

FY 1993

Review literature concerning recreational and commerical pricing for fisheries, and models assessing economic impacts of forest management on fisheries. Prepare a detailed study plan by March 31, 1993.

Develop model and pricing methods to determine management activity impacts on the fisheries resource.

Compare and contrast prices implied by management activities prices determined by recreation studies and commercial prices.

Prepare Ph.D. dissertation.

FY 1994

Prepare one or more draft manuscripts that summarize study results.

FY 1995

Manuscript completion and scientific exchange.

8. *Publication and Technology Transfer Activities*:

Prepare **COPE Report** articles and present results at workshops.

Participate in field trips and seminars as appropriate.

Publish study results.

Prepare Ph.D. dissertation.

9. *Estimated Cost*:

	PNW
FY 93	75,000
FY 94	79,000
FY 95	24,000

May 1992

Fundamental COPE
Study Prospectus

1. *Title*:

Management Policies for Increasing Recreation's Contribution to the Economies of Oregon Coast Range Communities

2. *Principal Investigators and Organizations*:

Dr. Rebecca L. Johnson, Associate Professor, Department of Forest Resources, Oregon State University, Corvallis, Oregon

Mr. Kreg Lindberg, Graduate Research Assistant, Department of Forest Resources, Oregon State University, Corvallis, Oregon

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

This study encompasses both the riparian and reforestation management issues.

4. *Study Objective(s)*:

a. Determine what is currently known about the economic, social, and ecological impacts of recreation/tourism in Oregon Coast Range counties.

b. Identify economic development goals and criteria for economic stability.

c. Identify and estimate tourism's economic impacts in coastal counties, and their relationship to development goals. Develop a model for tourism management based on integration of economic, social, and ecologic impacts.

d. Investigate relationships between forest management activities, level of demand for recreation, and resulting economic impact in Coast Range counties. When possible, quantify these relationships.

e. Evaluate and present management options for increasing tourism's contribution to Oregon Coast Range economies.

5. *Justification*:

Oregon Coast Range counties are currently undergoing a significant transition as the recreation/tourism industry is developed in an effort to diversify local and regional economies. While tourism already fills an important position in these economies, the long-term stability of this industry requires that future planning and management be based on knowledge of tourism's role in meeting economic goals, as well as knowledge of its social and ecologic impacts. Tourism's stability also depends critically on the management of the forestry sector since forest management practices directly and indirectly affect the tourism product.

Many coastal residents have become disappointed because tourism has not generated levels of income equivalent to the wood products industry, for which tourism has often been viewed as a replacement. Therefore, the first component of this project will involve estimating the current economic impact of tourism in Oregon Coast Range counties, with particular attention given to the nature of tourism employment (seasonality, wage level, etc.) and how such employment fits into economic goals. Opportunities for enhancing tourism's economic contribution will be identified. Tourism's economic impact will also be evaluated over time to identify likely future trends.

In addition, county governments and local communities increasingly recognize that tourism development can generate social and ecologic impacts. These impacts need to be incorporated into planning and management to ensure long-term economic stability. For example, negative social impacts in Cannon Beach and Seaside have led to restrictions on vacation rentals, and thus a reduction in economic benefits. This study will identify social and ecologic impacts and integrate them with economic impacts into a model for determining how tourism can be planned and managed to generate the greatest economic benefits with the fewest social and ecologic costs.

Furthermore, agencies responsible for managing Oregon Coast Range forests realize that management practices have an effect on the quality of the recreation experience, and thus tourism's impact on local economies. Therefore, this project will investigate this relationship and identify forest management practices which contribute to the enhancement of a healthy tourism economy.

This project will lead to a better understanding of tourism's current and potential role in diversifying Oregon Coast Range economies, a better understanding of how to manage tourism to enhance economic stabililty, and a better understanding of how forest management practices affect tourism's economic contribution to coastal counties.

6. *Anticipated Initiation and Completion Dates*:

October 1, 1992 to September 30, 1994

7. *Proposed Tasks to be Completed by Fiscal Year*:

FY 1993

Complete literature review (objectives a and d). Identify county economic goals (objective b).

FY 1994

Identify, estimate and model tourism impacts (objective c). Present recommended management options (objective e).

8. *Publication and Technology Transfer Activities*:

Prepare a final report. Present results to Coast Range communities at COPE workshops, or other appropriate meetings.

9. *Estimated Cost:*

	OSU
FY 93	20,000
FY 94	21,000

May 1992

Adaptive COPE
Study Prospectus

1. *Title*:

Long-term Response of Resident Cutthroat Trout to Forest Harvest in Headwater Drainages of Oregon's Coast Range

2. *Principal Investigators and Organizations*:

Arne Skaugset, Instructor, Department of Forest Engineering, Oregon State University, and Forest Hydrologist, Adaptive COPE team, Hatfield Marine Science Center, Newport, Oregon
James D. Hall, Professor, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon
Patrick J. Connally, Graduate Research Assistant, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon

This Ph.D. study was initiated in 1991 with support partially provided by Adaptive COPE.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

b. Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.

4. *Study Objective(s)*:

a. Characterize rate of recovery and status of cutthroat trout populations in streams bordered by forests that were harvested before adoption of Oregon's Forest Practice Rules in 1972.

b. Characterize stream morphology, hydrology, and riparian zones of stream areas selected for intensive fish population studies.

c. Determine when and how coastal cutthroat trout use headwater streams.

d. Evaluate importance of headwater streams to resident coastal cutthroat trout production and maintenance of populations in a basin.

e. Recommend changes, if needed, to current policy and management prescriptions for maintenance of coastal cutthroat trout populations in headwater streams bordered by maturing second growth forests.

5. *Justification*:

A question that needs to be addressed is whether past forest management practices impose limitations to the recovery of cutthroat trout populations to the extent of precluding insurance of future protection. Most forests that will be ready for a second or third harvest within the next 30 years were last harvested before the adoption of Forest Practice Rules in 1972. Streams that would qualify for maximum riparian protection today were commonly not afforded riparian protection prior to 1972. Because the recovery time for instream habitat may be longer than the planned rotation period for forest harvest, assessment of the fish population in a second growth drainage targeted for logging may not be indicative of the predisturbance level of fish production.

Few studies have been conducted on coastal cutthroat trout in streams bordered by second growth forest stands older than 25 years. Efforts to describe distribution, habitat use, and basic life history aspects of resident populations of cutthroat trout are needed and hold promise to be important in management decisions and prescriptions.

Vast areas of second growth forests are maturing and will be harvested in the near future. Existing streamside prescriptions in the Forest Practice Rules for northwestern Oregon were largely developed from studies (e.g., Alsea Watershed Study) of logging relatively undisturbed stream systems in mature forests. It has not been clearly shown that current Forest Practice Rules will provide on acceptable level of protection and recovery of cutthroat trout populations in formerly logged, headwater drainages.

6. *Anticipated Initiation and Completion Dates*:

June 2, 1992 to September 30, 1993

7. *Proposed Tasks to be Completed by Fiscal Year*:

FY 1993

Analyze data collected during summer 1991 and 1992 to determine habitat use and population densities of cutthroat trout in paired (harvested-unharvested) headwater drainages.

Conduct field work during late winter-early spring 1993.

Analyze field data as it becomes available to determine life history patterns and seasonal habitat use of cutthroat trouts in headwater streams.

Prepare a final study report.

8. *Publication and Technology Transfer Activities:*

Prepare an article for the **COPE Report**.

Present results at appropriate meetings.

Prepare an overview manuscript that will serve as a doctoral dissertation.

Prepare topic-specific manuscripts for publishing in refereed journals.

May 1992

Adaptive COPE
Study Prospectus

1. *Title*:

Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coast Range

2. *Principal Investigators and Organizations*:

Mr. Arne Skaugset, Instructor, Department of Forest Engineering, Oregon State University, and Forest Hydrologist, Adaptive COPE team, Hatfield Marine Science Center, Newport, Oregon
Dr. John Hayes, Assistant Professor, Department of Forest Sciences, Oregon State University, and Wildlife Biologist, Adaptive COPE team, Hatfield Marine Science Center, Newport, Oregon
Dr. Gabriel Tucker, Assistant Professor, Department of Forest Sciences, Oregon State University, and Silviculturist, Adaptive COPE team, Hatfield Marine Science Center, Newport, Oregon

This study will be conducted in cooperation with and in support of the Fundamental COPE study: "Harvesting Alternatives in Upland and Riparian Areas", Dr. Loren D. Kellogg, Principal Investigator. In conjunction with the Adaptive COPE study "The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands," this study will replace the Adaptive COPE study "Interdisciplinary Research and Demonstration Areas (IRDAP)."

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6)*:

Riparian Zone Management

a. Identify and explain how various management practices in streams and riparian areas affect water quality.

b. Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

c. Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.

d. Test and compare harvesting systems that enable managers to achieve various states of fish and wildlife habitat and levels of timber production in riparian areas.

4. *Study Objective(s):*

   a. To develop a process for prescribing active riparian management and stream enhancement activities in harvest regenerated stands with alder-dominated, debris-poor riparian areas and debris-poor streams.

   b. Help identify the logging planning, layout, and operational requirements to carry out the prescribed active riparian management and stream enhancement activities.

   c. Quantify the responses of multiple forest resources in the riparian zone to active riparian management and stream enhancement. Specifically:

      The effect of stream enhancement activities on the diversity and abundance of aquatic habitat types.

      The effect of active riparian zone management on selected water quality parameters.

      The effect of active riparian zone management activities on the establishment and growth of conifers in the riparian zone.

      The effect of active riparian zone management activities on the diversity and abundance of riparian wildlife habitat types.

5. *Justification*:

In the Oregon Coast Range there are many harvest regenerated stands which are functionally different from the naturally regenerated stands they have replaced. COPE research has shown that riparian areas in these stands are debris poor and, in general, the overstory is dominated by hardwoods, predominantly red alder, with a salmonberry understory. The streams flowing through these stands are, in general, debris poor with less total debris loading, smaller and shorter debris pieces. Furthermore, there is very little conifer regeneration. Finally, it has been hypothesized that management exclusion in riparian zones exacerbates the situation because the alder and salmonberry are retained, which ultimately may lead to salmonberry thickets as the dominant form of streamside vegetation.

The problem of management exclusion encouraging salmonberry thickets in alder dominated riparian zones is currently a subject of research for COPE. Part of this research is directed toward developing silvicultural systems designed to establish and encourage conifers to grow in alder dominated riparian zones and is generally refered to as riparian silviculture. This research has concentrated on plot level studies of the establishment or release of several different species of conifer in alder dominated riparian zones with different levels of both overstory and understory manipulation. However, this research can only help solve part of the problems of getting conifers established in alder dominated riparian zones. These conifers will take 100 or more years to become available to the stream as large woody debris.

To date, existing riparian silviculture research has largely not been interdisciplinary or conducted on an operational scale. It is the goal of this proposal to expand upon existing riparian silviculture and stream enhancement research by combining them on an operational scale. This study will accomplish overstory and understory manipulations by using timber harvesting equipment, nominally a yarder, during harvesting operations. Woody debris will be simultaneously added to the streams during the harvesting operation using a yarder.

This research will be done collaboratively with Dr. Loren Kellogg's Fundamental COPE project "Harvesting Alternatives in Upland and Riparian Areas." This cooperation will enable us to develop three research outputs. The first will be a description of the process by which the riparian silviculture and stream enhancement prescriptions are developed. This will involve an interdisciplinary team, including a logging engineer, silviculturist, wildlife biologist, and hydrologist doing an inventory of existing riparian conditions and deficiencies and developing a prescription for the stream and riparian area that involves placing large woody debris in the stream and overstory and/or understory manipulation in the riparian zone along with conifer establishment. The prescription will include logging planning and layout requirements for using a yarder to place large woody debris in a stream as well as manipulate the overstory and/or understory in close proximity to a stream in a riparian zone. The second research output will be the operational constraints, logging feasibility, human safety, logging production and costs associated with carrying out the prescriptions.

The final research output will be a monitoring of the efficacy of the prescriptions. This will include the establishment and growth of the conifers in the riparian zones, the wildlife habitat and perhaps some inventory of the wildlife in the riparian zone, the effects of active management in the riparian zone on water quality and aquatic habitat, and the effect of the large woody debris on fish habitat.

6. *Anticipated Initiation and Completion Dates*:

June 2, 1992 to September 30, 1998

7. *Proposed Tasks to be Completed by Fiscal Year*:

FY 1992

Prepare a draft study plan. Work with Dr. Loren Kellogg and cooperators to select study sites. Collect necessary preharvest data and develop the riparian silviculture, stream enhancement, and logging prescription. Help arrange the logistics for implementing the harvesting.

FY 1993

Implement harvesting and the riparian silviculture and stream enhancement treatments. Collect the requisite data.

FY 1994

Report results from harvest activities. Collect, and reduce first-year riparian silviculture and stream enhancement data.

FY 1995

Report first-year riparian silviculture and stream enhancement data. Collect and reduce second-year data.

FY 1996

Collect third-year data. Report results to date.

FY 1997

Collect fourth-year data. Report results to date.

FY 1998

Analyze and report project results. Synthesize project results with other COPE riparian silviculture and stream enhancement research results.

8. *Publication and Technology Transfer Activities*:

Present research concepts and results at COPE workshops and other appropriate forums, contribute to the **COPE Report**, contribute to the appropriate field tours organized by Adaptive COPE or others, publish study results as they become available in refereed journal articles and other publications.

May 1992

Adaptive COPE
Study Prospectus

1. *Title:*

The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-Fir Stands

2. *Principal Investigators and Organizations:*

Dr. Gabriel F. Tucker, Assistant Professor, Department of Forest Science, Oregon State University and Silviculturist, Adaptive COPE Team, Hatfield Marine Science Center, Newport, Oregon.

Dr. William H. Emmingham, Associate Professor, Department of Forest Science, Oregon State University, Corvallis, Oregon.

Dr. John P. Hayes, Assistant Professor, Department of Forest Science, Oregon State University and Wildlife Scientist, Adaptive COPE Team, Hatfield Marine Science Center Newport, Oregon.

Mr. Stuart Johnston, Silviculturist, Siuslaw National Forest, USDA Forest Service, Mapleton District, Mapleton, Oregon.

Mr. Sam Chan, Research Forester, USDA Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.

Mr. Arne Skaugset, Instructor, Department of Forest Engineering, Oregon State University and Forest Hydrologist, Adaptive COPE Team, Hatfield Marine Science Center, Newport, Oregon.

Ms. Barbara Schrader, Silviculture Research Assistant, Department of Forest Science, Oregon State University, Adaptive COPE Team, Hatfield Marine Science Center, Newport, Oregon.

Dr. Donald Minore, Principle Plant Ecologist, USDA Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.

Where possible, this project will be conducted in cooperation with and in support of the Adaptive COPE study: Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coast Range", Mr. Arne Skaugset, Principal Investigator and the Fundamental COPE Study: "Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range", Dr. Loren Kellogg, Principal Investigator.

3. *Management Issue and Research Tasks (COPE Long-Range Plan, Pages 3-6):*

Reforestation in the Oregon Coast Range

a. Develop and test strategies for reforestation that will be effective where ever coastal forests grow, even with constraints on fire and herbicides.

b. Identify relationships between wildlife populations, habitat, and wildlife damage to young conifer plantations.

Riparian Zone Management

a. Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.

4. *Study Objective(s):*

The primary objective of this study is to evaluate the effect of various commercial thinning and planting regimes on stand structural diversity relative to:

a. Behavior of overstory trees; survival, growth, and crown structure.

b. Dynamics of the understory vegetation (herbs and shrubs) following thinning to a range of spacings, including response to direct mechanical disturbance.

c. Behavior of various tree species when planted in the understory at various overstory densities, i.e., survival and growth.

d. Dynamics of stand structure/architecture over time.

e. Response of small mammals, reptiles, and amphibians to habitat created by stand manipulation.

f. Creation and longevity of snags in young stands.

g Silviculture investments and costs.

5. *Justification*:

Prescribing for stand structural and species diversity other than normally found in managed young Douglas-fir plantations has become a major concern of many silviculturists and forest managers in the Oregon Coast Range.

Wildlife biologists and forest ecologists have begun to recognize and understand the relationship between landscape patterns and stand structure to forest ecosystem functions. Although specific stand structural needs are still unknown for many wildlife species, structural patterns resembling mature natural forest have been suggested. Present research suggests that young stands can be manipulated to provide some of these habitat characteristics in a relatively short time frame. This involves thinning young stands to low densities to stimulate rapid growth of dominant trees and allow or encourage development of the understory. Currently, there is little growth and yield data to project stand development of such stands. This project will establish and monitor an array of stand density management regimes designed to establish multi-storied stands.

Our approach is to thin young (20-40 yr) plantations to a variety of densities including normal (100 tpa), wide (60 tpa), and very wide (30 tps). Controls (200-400 tps) will be left unthinned. In addition, planting of alder and four coniferous species in the understory will be planted to test the development of vertical structure and provide a comparison with unplanted areas. These combinations of overstory density and understory management will provided a wide array of vertical structures at various time intervals, and may provide mature natural forest habitat in a shorter time frame than the unmanaged (control) stands.

6. *Anticipated Initiation and Completion Dates*:

June 2, 1992 to September 30, 1998.

7. *Proposed Tasks to be Completed by Fiscal Year*:

FY 1992

Prepare detailed study plan.

Select study sites in conjunction with cooperators.

Conduct pretreatment sampling on first study site.

Harvest first study site.

FY 1994

Conduct pretreatment sampling of second and third sites.

Harvest second and third sites.

FY 1995

Post-treament sampling of silviculture and wildlife data.

FY 1996

Post-treatment sampling of silviculture and wildlife data.

FY 1997

Post-treatment sampling of silviculture and wildlife data.

FY 1998

Synthesis of results.

8. *Publication and Technology Transfer Activities:*

Preliminary results will be published in the **COPE Report** and final results will be published in refereed journal articles.

Practical demonstrations will be presented at ground field forums and other approparaite meetings.

RELATIONSHIP OF RESEARCH STUDIES TO COPE MANAGEMENT ISSUES and RESEARCH TASKS

RELATIONSHIP OF CONTINUING AND PROPOSED STUDIES TO MANAGEMENT ISSUES AND RESEARCH TASKS IDENTIFIED IN THE COPE LONG-RANGE PLAN[1]

Management Issue: **RIPARIAN ZONE MANAGEMENT**

Page

Research Task 1: Identify and explain the effects of various riparian and stream conditions on fish populations and communities.

Continuing Studies

Ecology and Inventory of Riparian Zone Vegetation 4

Fish Habitat and Riparian Zone Interactions 8

Disturbance History, Channel State, Fish Habitat, and Fish Production in Sandstone Basins of the Central Oregon Coast 35

Behavior of Debris Torrents and Effects on Anadromous Fish Habitat in the Oregon Coast Range 37

Estimation of Smolt Production from Drift Creek Study Basin 40

The Role and Management of Large Woody Debris for Fish Habitat in Coast Range Streams 107

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[1] A Long-Range Plan for completing the Coastal Oregon Productivity Enhancement (COPE) Program. April 1989. Forest Research Laboratory, Oregon State University, Corvallis. 15 p.

Page

Research Task 1: **Identify and explain the effects of various riparian and stream conditions on fish populations and communities.**

Continuing Studies

The Utilization of Unconstrained Stream Reaches by Salmonids in the Oregon Coast Range 46

Evaluation of Anadromous Salmonid Habitat Restoration Program on Schooner Creek, Hebo Ranger District, Siuslaw National Forest 49

Proposed Studies

Long-Term Response of Resident Cutthroat Trout to Forest Harvest in Headwater Draninages of Oregon's Coast Range 155

Research Task 2: **Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.**

Continuing Studies

Fish Habitat and Riparian Zone Interactions 8

Forest Management of Landslide-Prone Sites: Stability Evaluation, Effectiveness of Leave Areas, and Effects of Landslides on Riparian and Fisheries Resources 13

Hybrid Poplar and Red Alder in Coastal Riparian Zones for Non-Point Source Pollution Control, Fish and Wildlife Habitat, and Wood Fiber 20

Disturbance History, Channel State, Fish Habitat, and Fish Production in Sandstone Basins of the Central Oregon Coast 35

Behavior of Debris Torrents and Effects on Anadromous Fish Habitat in the Oregon Coast Range 37

Estimation of Smolt Production From Drift Creek Study Basin 40

Page

Research Task 2: **Identify and explain how various management practices in streams and riparian areas affect fish populations and communities and water quality.**

Continuing Studies (continued)

Active Management of Riparian Zones for Multiple Resources: III. Influence of Woody Debris Piece Size on Function in Small Streams 117

The Utilization of Unconstrained Stream Reaches by Salmonids in the Oregon Coast Range 46

Evaluation of Anadromous Salmonid Habitat Restoration Program on Schooner Creek, Hebo Ranger District, Siuslaw National Forest 49

Proposed Studies

Long-Term Response of Resident Cutthroat Trout to Forest Harvest in Headwater Draninages of Oregon's Coast Range 155

Research Task 3: **Identify wildlife species in and adjacent to riparian habitats.**

Continuing Studies

Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach 16

Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes 132

Proposed Studies

None

Research Task 4: **Characterize wildlife communities in riparian and adjacent upland habitats and assess how changes in habitat affect wildlife species.**

Continuing Studies

Ecology and Inventory of Riparian Zone Vegetation 4

Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach 16

Ecology and Habitat Relationships of Selected Riparian-Associated Wildlife 43

Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes 132

Adaptation of a Forest Succession and Wildlife Habitat Model to Managed Coast Range Forests 135

Proposed Studies

Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands 162

Research Task 5: **Develop silvicultural systems to maintain and improve fish and wildlife habitats in riparian areas and increase conifer development there.**

Continuing Studies

Ecology and Inventory of Riparian Zone Vegetation 4

Fish Habitat and Riparian Zone Interactions 8

Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach 16

Hybrid Poplar and Red Alder in Coastal Riparian Zones for Non-Point Source Pollution Control, Fish and Wildlife Habitat, and Wood Fiber 20

The Dynamics and Silviculture of Riparian Vegetation 31

Ecology and Habitat Relationships of Selected Riparian-Associated Wildlife 43

Establishment and Growth of Conifers Under Existing Riparian Vegetation 109

Active Management of Riparian Zones for Multiple Resources: II. Release of Suppressed and Intermediate Conifers in Alder-Dominated Riparian Zones of the Oregon Coast Range 113

Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions 53

Interdisciplinary Research and Demonstration Area (IRDAP) (The Adaptive COPE Team, OSU) 124

Proposed Studies

Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coastal Range 158

Page

Research Task 6: **Test and compare harvesting systems that enable managers to achieve various states of fish and wildlife habitat and levels of timber productionin riparian areas.**

Continuing Studies

Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions 53

Proposed Studies

Harvesting Alternatives in Upland and Riparian Areas in the Oregon Coast Range 147

Integrated Response of Multiple Forest Resources to Active Management in Riparian Zones of the Oregon Coast Range 158

Research Task 7: **Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.**

Continuing Studies

Forest Management on Landslide-Prone Sites: Stability Evaluation, Effectiveness of Leave Areas, and Effects of Landslides on Riparian and Fisheries Resources 13

Ground Water Movement in Steep Forested Hill-Slopes with Particular Focus on Marginally Stable "Head-Walls" 23

Behavior of Debris Torrents and Effects on Anadromous Fish Habitat in the Oregon Coast Range 37

Modeling Root Reinforcement in Shallow Forest Soils 104

Stability Assessment of End-Haul Disposal Areas 121

Page

Research Task 7: **Develop, refine, and test systems for predicting and reducing landslides, surface erosion, and sediment delivery to stream channels.**

Continuing Studies (continued)

Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions 53

Strength Behavior of Forest Soils Under True Field Stresses 57

Proposed Studies

None

Research Task 8: **Develop economic models capable of assessing the economic impacts of various management regimes in riparian zones, and apply them to conditions prevailing on the Oregon coast.**

Continuing Studies

None

Proposed Studies

Economic Analysis of Forest Management-Fisheries Interactions 150

Page

Research Task 9: Identify and integrate associations among ecosystem components (for example, vegetation, geomorphology, fish) in riparian areas and explain their ecological relationships.

Continuing Studies

Ecology and Inventory of Riparian Zone Vegetation 4

Fish Habitat and Riparian Zone Interactions 8

Forest Management on Landslide-Prone Sites: Stability Evaluation, Effectiveness of Leave Areas, and Effects of Landslides on Riparian and Fisheries Resources 13

Wildlife Habitat and Wildlife Diversity in Riparian Zones: A Gradient Approach 16

Coastal Landscape Analysis and Modeling 26

Harvesting in Headwater Basins for Alternative Silvicultural Prescriptions 53

Interdisciplinary Research and Demonstration Area (IRDAP) (The Adaptive COPE Team, OSU) 124

Proposed Studies

None

Management Issue: **REFORESTATION IN THE OREGON COAST RANGE**

Page

Research Task 1: **Develop and test strategies for reforestation that will be effective wherever coastal forests grow, even with constraints on prescribed fire and herbicides.**

Continuing Studies

Ecology and Management of Shrubs and Hardwoods in Coastal Forests 65

Characterization of the Thermal Environment for Developing Guidelines to Manage Shrubs and Hardwoods in Coastal Forests 69

Second Decade Effects of Site Preparation on Tree and Vegetation Development With or Without Precommercial Thinning 72

Identification of Potential Brush and Hardwood Problem Sites 95

A Synthesis of Reforestation Practices with Constraints on Fire and Herbicides 129

Effects of Forage Seeding on Establishment and Growth of Douglas-fir Seedlings 139

Decision Support System for Reforestation in the Oregon Coast Range 98

Proposed Studies

The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir stands 162

Page

Research Task 2: **Examine the economics of different reforestation strategies and assess the economic impacts of constraints on fire and herbicides.**

Continuing Studies

Ecology and Management of Shrubs and Hardwoods in Coastal Forests 65

Second Decade Effects of Site Preparation on Tree and Vegetation Development With and Without Precommercial Thinning 72

A Synthesis of Reforestation Practices with Constraints on Fire and Herbicides 129

Effects of Forage Seeding on Establishment and Growth of Douglas-fir Seedlings 142

Proposed Studies

None

Page

Research Task 3: Identify the effects of prescribed fire on long-term site productivity and develop methods to reduce adverse impacts.

Continuing Studies

Second Decade Effects of Site Preparation on Tree and Vegetation Development With and Without Precommercial Thinning 72

Asymbiotic Nitrogen Fixation in Large Woody Residues of Oregon Coastal Forests 80

Proposed Studies

None

Research Task 4: Develop and test ways of reducing root rot damage in new plantation.

Continuing Studies

Species Manipulation as a Strategy to Reduce the Impact of Laminated Root Rot in Regenerated Coastal Stands 76

Characterization of *Trichoderma* spp.: Prelude to Biological Control 83

Rate of Spread of *Phellinus Weirii* in Living and Dead Root Systems 86

Chemical Control of *Phellinus* (*Poria*) *Weirii* Part III--Application of Chloropicrin or Methyl Isothiocyanate (MS) to Live Infected Trees 89

Page

Research Task 4: **Develop and test ways of reducing root rot damage in new plantation.**

Continuing Studies (continued)

The Influence of Tree Vigor on Infestation of Douglas-fir by *Phellinus Weirii* 92

Proposed Studies

None

Research Task 5: **Identify relationships between wildlife populations, habitat, and damage to young conifer plantations.**

Continuing Studies

Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes 132

Adaptation of a Forest Succession and Wildlife Habitat Model to Managed Coast Range Forests 135

Proposed Studies

The Application of Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands 162

Research Task 6: **Develop conceptual models of habitat manipulation in order to learn how to minimize animal damage to young conifer plantations.**

Continuing Studies

Patterns of Wildlife Abundance and Diversity in Managed Upland Forest Landscapes 132

Adaptation of a Forest Succession and Wildlife Habitat Model to Managed Coast Range Forests 135

Proposed Studies

None

Management Issue: **THESE STUDIES ENCOMPASS BOTH RIPARIAN ZONE MANAGEMENT AND REFORESTATION IN THE OREGON COAST RANGE**

Page

Continuing Studies

Integrating and Managing Recreation with Other Resources 60

Socioeconomic Research Feasibility Study 63

Proposed Studies

Management Policies for Increasing Recreation's Contribution to the Economics of Oregon Coast Range Communities 152

The Applicationof Commercial Thinning to Increase Structural Diversity in Young Douglas-fir Stands 162

BUDGETS FOR FY 92 and FY 93
FUNDAMENTAL COPE
ADAPTIVE COPE

May 1992

Fundamental COPE

Combined OSU and PNW Budget Summary
FY 92 and FY 93

Projected Expenditures

	FY 92 (anticipated)	FY 93 (anticipated)
OSU[1]	$1,026,500	$ 997,000
PNW[1]	1,151,500	1,212,000
Total	**$2,178,000**	**$2,209,000**

Revenues

	FY 92 (appropriation)	FY 93 (anticipated)
USDA, FS	$1,050,000	$1,050,000
USDI, BLM	1,128,000	1,159,000
Total	**$2,178,000**	**$2,209,000**

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[1] Includes funds necessary for program administration and research support service.

May 1992

Adaptive COPE

Budget Summary
FY 92 and FY 93

Expenditures	FY 92 (anticipated)	FY 93 (requested)
Personnel (salaries, wages, and OPE)	$292,000	$331,000
Services and Supplies	74,000	52,000
Travel	30,000	41,000
Capital Costs (equipment, facilities)	15,000	40,000
Indirect Costs	20,000	21,000
Tuition Remission	0	0
Total	**$431,000**	**$485,000**

Revenues	FY 92 (anticipated)	FY 93 (requested)
BLM Districts	$172,000	$141,000
National Forests	100,000	100,000
Industry	134,000	134,000
Oregon Dept. of Forestry	50,000	50,000
Counties	17,500	17,500
Oregon Dept. Fish & Wildlife	5,500	5,500
Oregon Small Woodland Assoc.	200	200
U.S. Fish & Wildlife	5,000	5,000
Bureau of Indian Affairs	10,000	10,000
Carryover	117,076	180,276
Total	**$611,276**	**$643,476**